UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103

MEMORANDUM

DATE: November 30, 1999

SUBJECT: Technical Support Document for the One-Hour Ozone Attainment Demonstrations submitted by the State of Maryland, Commonwealth of Virginia and the District of Columbia for the Metropolitan Washington, D.C. Ozone Nonattainment Area (DC039-2019, VA090-5036, MD073-3045)

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TO: File

THRU: 11/30/99
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Attached is the Technical Support Document for the One-Hour Ozone Attainment Demonstration for the Metropolitan Washington DC Ozone Nonattainment Area submitted by the State of Maryland, the District of Columbia and the Commonwealth of Virginia.

Attachment

Technical Support Document for the One-Hour Ozone Attainment Demonstration for the Metropolitan Washington DC Ozone Nonattainment Area

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ATTACHMENTS

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Attachment 2., *NOx SIP Call for Regional Modeling to Supplement 1-hour SIP's*, Bill Hunt, USEPA, OAQPS, July 10, 1998, Interoffice Memorandum

Attachment 3., *Adjusted 1-Hour Ambient County Design Values (1994-1996) Within the Regional Modeling Domain*, USEPA, 1998.

Attachment 4., *Model-Predicted Peak Ozone Concentrations from OTAG Run I and Run 5 for July 20, 1991*, OTAG Midwest Modeling Center WEB Site: http://sage.mcnc.org/OTAGDCC/aqm/uamv/jul91

Attachment 5., *Improving Weight of Evidence Through Identification of Additional Emission Reductions Not Modeled*, U.S. Environmental Protection Agency, Office if Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Air Quality Modeling Group, RTP, NC, October 1999

I. Scope and Content of this Document

This document was prepared to document and address the adequacy of the technical procedures employed by the District of Columbia (DC), the State of Maryland (MD) and the Commonwealth of Virginia (VA) in the completion of the ozone attainment modeling demonstration presented in their submittal entitled, **State Implementation Plan (SIP) Revision, Phase II Attainment Plan for the Washington DC-MD-VA Nonattainment Area.** EPA believes that the combination of local scale modeling and weight-of-evidence arguments presented in the DC-MD-VA plan demonstrates attainment of the 1-hour ozone standard for the National Capital Interstate ozone nonattainment area.

The Technical Support Document (TSD) is structured in the following way. Section II provides general background information regarding the Phase II Plan. Section III provides a technical description of the local scale modeling and includes discussions on model and model setup, episodes, emissions and model performance and sensitivity runs. Section IV contains discussions of the corroborating information presented in the DC-MD-VA plan to support the conclusion that it is likely the National Capital Interstate ozone nonattainment area will attain the 1-hour ozone standard by 2005. Maryland, Virginia and the District have applied for an attainment date extension from November 15, 1999 to November 15, 2005 to allow time for the implementation of regional NOx emission controls and due to transport from upwind areas with a later attainment date. Whether or not to grant the requested attainment date extension is also the subject of this TSD. Section V is a summary discussion of all the modeling and weight of evidence information contained in the TSD, including EPA's final comments on the adequacy of the attainment demonstration modeling. [redacted]

II. Background and General Requirements

II.A. What are the Clean Air Act requirements for attainment demonstration SIPs?

1. CAA Requirements

The Clean Air Act (CAA) requires EPA to establish national ambient air quality standards (NAAQS or standards) for certain widespread pollutants that cause or contribute to air pollution that is reasonably anticipated to endanger public health or welfare. CAA §§ 108 and 109. In 1979, EPA promulgated the 1-hour 0.12 parts per million (ppm) ground-level ozone standard. 44 FR 8202 (Feb. 8, 1979). Ground-level ozone is not emitted directly by sources. Rather, emissions of nitrogen oxides (NOx) and volatile organic compounds (VOCs) react in the presence of sunlight to form ground-level ozone. NOx and VOC are referred to as precursors of ozone.

An area exceeds the 1-hour ozone standard each time an ambient air quality monitor records a 1-hour average ozone concentration above 0.124 ppm. An area is violating the standard if, over a consecutive three-year period, more than three exceedances are expected to occur at any one monitor. The CAA, as amended in 1990, required EPA to designate as nonattainment any area that was violating the 1-hour ozone standard, generally based on air quality monitoring data from the three-year period from 1987-1989. CAA § 107(d)(4); 56 FR 56694 (Nov. 6, 1991). The CAA further classified these areas, based on the area's design value, as marginal, moderate, serious, severe or extreme. CAA §181(a). Marginal areas were suffering the least significant air pollution problems while the areas classified as severe and extreme had the most significant air pollution problems.

The control requirements and dates by which attainment needs to be achieved vary with the area's classification. Marginal areas are subject to the fewest mandated control requirements and have the earliest attainment date. Severe and extreme areas are subject to more stringent planning requirements but are provided more time to attain the standard. Serious areas are required to attain the 1-hour standard by November 15, 1999 and severe areas are required to attain by November 15, 2005 or November 15, 2007. The Washington area is classified as serious and its attainment date is November 15, 1999.

Under section 182(c)(2) and (d) of the CAA, serious and severe areas were required to submit by November 15, 1994, demonstrations of how they would attain the 1-hour standard and how they would achieve reductions in VOC emissions of 9 percent for each three-year period until the attainment year (rate-of-progress or ROP). (In some cases, NOx emission reductions can be substituted for the required VOC emission reductions.) Today, in this proposed rule, EPA is proposing action on the attainment demonstration SIP submitted by District of Columbia's Department of Health (DoH), the Maryland Department of the Environment (MDE) and the Virginia Department of Environmental Quality (VADEQ) for the Washington area. EPA will take action on the District's, Maryland's and Virginia's ROP plans for the Washington area in separate rulemaking actions.

In general, an attainment demonstration SIP includes a modeling analysis component showing how the area will achieve the standard by its attainment date and the control measures necessary to achieve those reductions. Another component of the attainment demonstration SIP is a motor vehicle emissions budget for transportation conformity purposes. Transportation conformity is a process for ensuring that States[1] consider the effects of emissions associated with new or improved federally-funded roadways on attainment of the standard. As described in section 176(c)(2)(A), attainment demonstrations necessarily include the estimates of motor vehicle emissions that are consistent with attainment, which then act as a budget or ceiling for the purposes of determining whether transportation plans and projects conform to the attainment SIP.

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[1] Under the CAA, the District of Columbia has the same attainment planning authorities and responsibilities as any other of the fifty States.

2. History and Time Frame for the State's Attainment Demonstration SIP

Notwithstanding significant efforts by the States, in 1995 EPA recognized that many States in the eastern half of the United States could not meet the November 1994 time frame for submitting an attainment demonstration SIP because emissions of NOx and VOC in upwind States (and the ozone formed by these emissions) affected these nonattainment areas and the full impact of this effect had not yet been determined. This phenomenon is called ozone transport.

On March 2, 1995, Mary D. Nichols, EPA's then Assistant Administrator for Air and Radiation, issued a memorandum to EPA's Regional Administrators acknowledging the efforts made by States but noting the remaining difficulties in making attainment demonstration SIP submittals.[2] Recognizing the problems created by ozone transport, the March 2, 1995 memorandum called for a collaborative process among the States in the eastern half of the country to evaluate and address transport of ozone and its precursors. This memorandum led to the formation of the Ozone Transport Assessment Group (OTAG)[3] and provided for the States to submit the attainment demonstration SIPs based on the expected time frames for OTAG to complete its evaluation of ozone transport.

In June 1997, OTAG concluded and provided EPA with recommendations regarding ozone transport. The OTAG generally concluded that transport of ozone and the precursor NOx is significant and should be reduced regionally to enable States in the eastern half of the country to attain the ozone NAAQS.

In recognition of the length of the OTAG process, in a December 29, 1997 memorandum, Richard Wilson, EPA's then Acting Assistant Administrator for Air and Radiation, provided until April 1998 for States to submit the following elements of their attainment demonstration SIPs for serious and severe nonattainment areas: (1) evidence that the applicable control measures in subpart 2 of part D of title I of the CAA were adopted and implemented or were on an expeditious course to being adopted and implemented; (2) a list of measures needed to meet the remaining ROP emissions reduction requirement and to reach attainment; (3) for severe areas only, a commitment to adopt and submit target calculations for post-1999 ROP and the control measures necessary for attainment and ROP plans through the attainment year by the end of 2000; (4) a commitment to implement the SIP control programs in a timely manner and to meet ROP emissions reductions and attainment; and (5) evidence of a public hearing on the State submittal. (Memorandum, "Guidance for Implementing the 1-Hour Ozone and Pre-Existing PM 10 NAAQS," issued December 29, 1997. A copy of this memorandum may be found on EPA's web site at http://www.epa.gov/ttn/oarpg/t1pgm.html.) This submission is sometimes referred

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[2] Memorandum, "Ozone Attainment Demonstrations," issued March 2, 1995. A copy of the memorandum may be found on EPA's web site at http://www.epa.gov/ttn/oarpg/t1pgm.html .

[3] Letter from Mary A. Gade, Director, State of Illinois Environmental Protection Agency to Environmental Council of States (ECOS) Members, dated April 13, 1995.

to as the Phase 2 submission. Motor vehicle emissions budgets can be established based on a commitment to adopt the measures needed for attainment and identification of the measures needed. Thus, State submissions due in April 1998 under the Wilson policy should have included a motor vehicle emissions budget.

Building upon the OTAG recommendations and technical analyses, in November 1997, EPA proposed action addressing the ozone transport problem. In its proposal, the EPA found that current SIPs in 22 States and the District of Columbia (23 jurisdictions) were insufficient to provide for attainment and maintenance of the 1-hour standard because they did not regulate NOx emissions that significantly contribute to ozone transport. 62 FR 60318 (Nov. 7, 1997). The EPA finalized that rule in September 1998, calling on the 23 jurisdictions to revise their SIPs to require NOx emissions reductions within the State to a level consistent with a NOx emissions budget identified in the final rule. 63 FR 57356 (Oct. 27, 1998). This final rule is commonly referred to as the NOx SIP Call.

3. Attainment Date Delays Due to Transport

On July 16, 1998, EPA's then Acting Assistant Administrator, Richard Wilson, issued a guidance memorandum intended to provide further relief to areas affected by ozone transport. Memorandum, "Extension of Attainment Dates for Downwind Transport Areas," issued July 16, 1998. This memorandum is applicable to both moderate and serious ozone nonattainment areas. A copy of this policy may be found on EPA's web site at http://www.epa.gov/ttn/oarpg/t1pgm.html . The memorandum recognized that many moderate and serious areas are affected by transported pollution from either an upwind area in the same State with a higher classification and later attainment date, and/or from an upwind area in another State that is significantly contributing to the downwind area's nonattainment problem. The policy recognized that some downwind areas may be unable to meet their own attainment dates, despite doing all that was required in their local area, because an upwind area may not have adopted and implemented all of the controls that would benefit the downwind area through control of transported ozone before the downwind area's attainment date. Thus, the policy provided that upon a successful demonstration that an upwind area has interfered with attainment and that the downwind area is adopting all measures required for its local area for attainment but for this interference, EPA may grant an extension of the downwind area's attainment date. Local area measures would include all of the measures within the local modeling domain that were relied on for purposes of the modeled attainment demonstration. Once an area receives an extension of its attainment date based on transport, the area would no longer be subject to reclassification to a higher classification and subject to additional requirements for failure to attain by its original attainment date provided it was doing all that was necessary locally. The policy provides that the area must meet four criteria to receive an attainment date extension. In summary, the area must: (1) be identified as a downwind area affected by transport from either an upwind area in the same State with a later attainment date or an upwind area in another State that significantly contributes to downwind nonattainment; (2) submit an approvable attainment demonstration with any necessary, adopted local measures and with an attainment date that reflects when the upwind reductions will occur; (3) adopt all local measures required under the area's current classification

and any additional measures necessary to demonstrate attainment; and (4) provide that it will implement all adopted measures as expeditiously as practicable, but no later than the date by which the upwind reductions needed for attainment will be achieved.

A request from the State of Maryland, the Commonwealth of Virginia and the District of Columbia for such an extension of the attainment date for the Washington nonattainment area and EPA's proposed response is discussed in this action.

II. B. What guidance and policy has EPA issued?

The documents and their location on EPA's web site are listed below; these documents will also be placed in the docket for this proposal action.

Recent Documents:

1. "Guidance for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled." U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC 27711. November 1999. Web site: http://www.epa.gov/ttn/scram/.
2. "Serious and Severe Ozone Nonattainment Areas: Information on Emissions, Control Measures Adopted or Planned and Other Available Control Measures." Draft Report. November 3, 1999. Ozone Policy and Strategies Group. U.S. EPA, RTP, NC. Web site: www.epa.gov/ttn/oarpg/t1main.html.
3. Memorandum, "Guidance on Motor Vehicle Emissions Budgets in One-Hour Attainment Demonstrations," from Merrylin Zaw-Mon, Office of Mobile Sources, to Air Division Directors, Regions I-VI. November 3, 1999. Web site: http://www.epa.gov/oms/transp/traqconf.htm.
4. Memorandum from Lydia Wegman and Merrylin Zaw-Mon to the Air Division Directors, Regions I-VI, "1-Hour Ozone Attainment Demonstrations and Tier 2/Sulfur/Sulfur Rulemaking." November 8, 1999. Web site: http://www.epa.gov/oms/transp/traqconf.htm.
5. Draft Memorandum, "1-Hour Ozone NAAQS--Mid-Course Review Guidance." From John Seitz, Director, Office of Air Quality Planning and Standards. Web site: http://www.epa.gov/ttn/scram/.
6. Memorandum, "Guidance to Clarify EPA's Policy on What Constitutes 'As Expeditiously as Practicable' for Purposes of Attaining the One-Hour Ozone Standard for Serious and Severe Ozone Nonattainment Areas." John S. Seitz, Director, Office of Air Quality Planning and Standards. November 1999. Web site: http://www.epa.gov/ttn/oarpg/t1pgm.html.

Previous Documents:

1. U.S. EPA, (1991), Guideline for Regulatory Application of the Urban Airshed Model, EPA-450/4-91-013, (July 1991). Web site: http://www.epa.gov/ttn/scram/ (file name: "UAMREG").
2. U.S. EPA, (1996), Guidance on Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS, EPA-454/B-95-007, (June 1996). Web site: http://www.epa.gov/ttn/scram/ (file name: "O3TEST").
3. Memorandum, "Ozone Attainment Demonstrations," from Mary D. Nichols, issued March 2, 1995. Web site: http://www.epa.gov/ttn/oarpg/t1pgm.html .
4. Memorandum, "Extension of Attainment Dates for Downwind Transport Areas," issued July

16, 1998. Web site: http://www.epa.gov/ttn/oarpg/t1pgm.html.
5. December 29, 1997 Memorandum from Richard Wilson, Acting Assistant Administrator for Air and Radiation "Guidance for Implementing the 1-Hour Ozone and Pre-Existing PM_{10} NAAQS." Web site: http://www.epa.gov/ttn/oarpg/t1pgm.html

II. C. What is the framework for approving the attainment demonstrations?
In addition to the modeling analysis and weight-of-evidence support demonstrating attainment, the EPA has identified the following key elements which must be present in order for EPA to approve or conditionally approve the 1-hour attainment demonstration SIPs. These elements are listed below. Because the framework will be described in detail in the Notice of Proposed Rulemaking the framework will not be described in further detail here.

1. **CAA measures and measures relied on in the modeled attainment demonstration SIP** - This includes adopted and submitted rules for all previously required CAA mandated measures for the specific area classification. This also includes measures that may not be required for the area classification but that the State relied on in the SIP submission for attainment or ROP.

2. **NOx reductions consistent with the modeling demonstration**

3. **Motor vehicle emissions budget** - A motor vehicle emissions budget which can be determined by EPA to be adequate for conformity purposes.

4. **Tier 2/Sulfur program benefits where needed to demonstrate attainment** - Inclusion of reductions expected from EPA's Tier 2 tailpipe and low sulfur-in-fuel standards in the attainment demonstration and the motor vehicle emissions budget.

5. **In certain areas additional measures to further reduce emissions to support the attainment test** - Additional measures may be measures adopted regionally such as in the Ozone Transport Region (OTR), or locally (intrastate) in individual States.

6. **Mid-course review** - An enforceable commitment to conduct a mid-course review and evaluation based on air quality and emission trends. The mid-course review would show whether the adopted control measures are sufficient to reach attainment by the area's attainment date, or that additional control measures are necessary.

II. D. What are the areas covered under the Metropolitan Washington, D.C. attainment SIP?

The Metropolitan Washington area is designated as a serious ozone nonattainment area. The Clean Air Act set an attainment year of 1999 for both the Metropolitan Washington serious nonattainment area.

The Metropolitan Washington ozone nonattainment area consists of the following areas:

The entire District of Columbia (see 40 CFR 81.309).

The following counties in Maryland(see 40 CFR 81.321):

Calvert County
Charles County
Frederick County
Montgomery County
Prince George's County

And the following counties and cities in Virginia (see 40 CFR 81.347):

Alexandria City
Arlington County
Fairfax City
Fairfax County
Falls Church City
Loudoun County
Manassas City
Manassas Park City
Prince William County
Stafford County

II. E. When did the District of Columbia, Maryland, and Virginia Submit the Attainment Demonstration?

Table II. Dates of Attainment Demonstration Submittal

Description of Submittal	State		
	Maryland	Virginia	The District of Columbia
Phase I Submittal	December 24, 1997	December 17, 1997	November 3, 1997
Phase II Submittal	April 24, 1998	April 29, 1998	April 24, 1998
Supplemental Phase II	August 17, 1998	August 18, 1998	October 27, 1998
Attainment Date Extension Request	September 20, 1999	July 16, 1999	September 3, 1999

The States submitted the Phase I attainment plans under the March 2, 1995 policy in the fall of 1997. The States submitted the Phase II plans in April 1998 with a suppplemental submittal later

that year. The States requested attainment date extension under the July 16, 1998 transport policy during 1999.

The District of Columbia's, Maryland's, and Virginia's attainment SIP for the Metropolitan Washington serious nonattainment area relies on a combination of local, regional and federal measures adopted by the State and federal government since passage of the 1990 amendments to the Clean Air Act.

II.F. What is the Adoption Status of the Measures modeled in the Attainment SIP?

The tables in section III.F below provide the status of each control measure modeled by the District of Columbia Department of Health's Environmental Health Administration, the Maryland Department of Environment and the Virginia Department of Environmental Quality in the attainment SIP. The tables show the state adoption date of the measure, the implementation and/or compliance date of the measure and the approval status of the measure. EPA has previously analyzed the District of Columbia's, Maryland's, and Virginia's control measure strategies for effectiveness, enforceability and approvability. More information on the appropriateness of the District of Columbia's, Maryland's, and Virginia's strategies can be found in the individual rulemaking dockets associated with EPA's SIP approvals of the underlying regulations and other SIP planning documents such as the rate-of-progress plans for the Metropolitan Washington nonattainment area.

III. Local Modeling

III.A. Description of Models

The Clean Air Act Amendments of 1990 require that serious areas and above perform photochemical grid modeling to help determine the emission reductions of volatile organic compounds (VOC) and nitrogen oxides (NOx) necessary to achieve the attainment of the 1-hour ozone standard. Maryland, Virginia and the District of Columbia fulfilled this requirement through the Virginia Department of Environmental Quality's (VADEQ) application of the Urban Airshed Model, Version 4 (UAM-IV) for the National Capital area and through the use of the modeling results from the Ozone Transport Assessment Group (OTAG) application of the Urban Airshed Model, Version 5 (UAM-V).

The UAM-IV, UAM-V models are suitable for evaluating the air quality effects of emission control scenarios because they account for the spacial and temporal variations in emissions and emission reactivity. This is achieved by using the model to replicate an historical ozone episode through the use of observed meteorological data, emissions data and air quality data for the selected episode days. The results of this base case analysis are then evaluated to determine the adequacy of the performance of the model. Once the model results have been evaluated and determined to perform within prescribed levels, the same base year meteorological inputs for

each episode are combined with attainment year projected emission inventories to simulate the benefits of various emission control scenarios in bringing an area into attainment.

The UAM-IV model, used in the modeling demonstration for the National Capital area, is the regulatory version approved by the EPA. UAM-IV incorporates the Carbon-Bond IV (CB-IV) chemical mechanism. The UAM-V model used by OTAG is an updated version (Version 1.24). It incorporates the CB-IV chemical mechanism with updated isoprene and radical-radical reactions. Features of the UAM-V modeling system include variable vertical grid structure, two-way nested grid, plume-in grid treatment, etc. A detailed description of the UAM-V modeling system is provided in the user's guide.

III.B. Episodes

VADEQ focused on two episodes (July 15-16, 1991 and July 18-20, 1991) in their attainment year modeling demonstration. These episodes correspond to episodes selected for analysis by OTAG and represent one of the most frequently occurring weather patterns conducive to high ozone in the Philadelphia area. A description of the modeled episodes follow.

July 15-16, 1991

- Surface ozone concentrations indicated a large area of high ozone concentrations across the Northeast regions.

- Synoptic weather conditions showed a large area of high pressure building over the central plains gradually moving east so that much of eastern United States was covered by high pressure for six to seven days. On July 16th the High pressure system was centered over Pennsylvania. Temperatures exceeded 90 degrees Fahrenheit for several days in the Midwest, Northeast and Southeast regions. These conditions allowed pollutant concentrations to build up to high levels.

- Synoptic weather conditions suggested some interstate transport but minimal interregional transport.

July 18-20, 1991

- Surface ozone concentrations indicated a large area of high ozone concentrations across the Midwest and Northeast regions.

- Synoptic weather conditions showed a large area of high pressure building over the central plains and moving gradually east so that much of eastern United states was covered by high pressure for several days. Temperatures exceeded 90°F for several days in the Midwest and Northeast regions. These conditions allowed pollutant concentrations to build up to high levels.

- Progression of high ozone concentrations and synoptic weather conditions suggested interstate and interregional transport.

III.C. Model Setup

The origin of the initial grid in the Baltimore/Washington D.C. modeling domain is 250 kilometers (km) east and 4,235 km north, in UTM zone 18, near the Virginia town of Richards Shop. The domain's northward extent is 250 km north and its eastward extent is 200 km east of the origin. Each grid cell in the domain is a 5 km x 5 km square. The domain includes all nonattainment counties as well as many surrounding attainment counties and includes all or portions of Pennsylvania, Delaware, Virginia and the District of Columbia. The effectiveness of National Capital area control strategies were evaluated in a subdomain of the larger Baltimore /Washington domain that has the same origin as the larger domain with dimensions of 32 x 23 cells. Figure III.C-1 is a map of the Baltimore/Washington modeling domain.

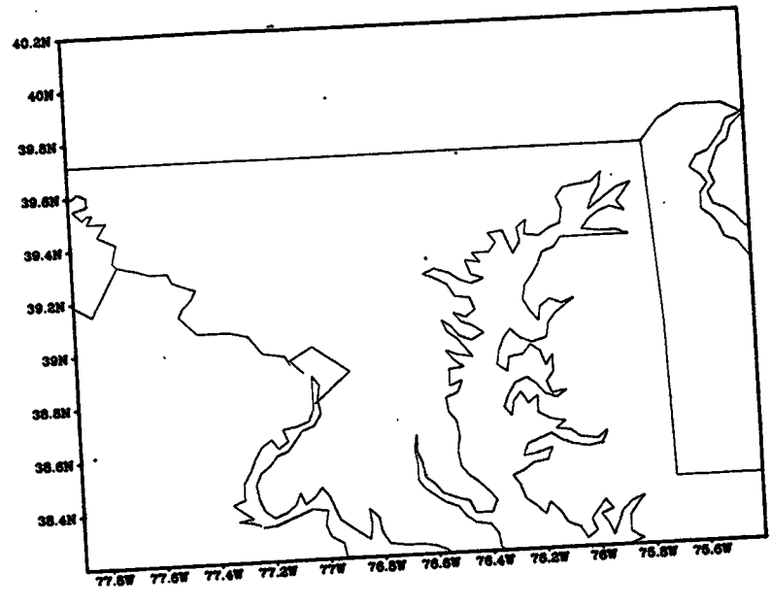

Figure III.C-1 Baltimore/Washington Modeling Domain

UAM-IV was run using five vertical layers with three layers above the morning mixing height (diffusion break in UAM). Additionally, the top of the modeling domain (region top in UAM) was specified above the mixing height by at least the depth of one upper layer cell. This was accomplished by setting the region top value equal to the maximum mixing depth plus the minimum depth of the upper layer cells.

Initial and boundary conditions were derived from OTAG modeling results from episodes corresponding to the local episodes chosen. OTAG Run I was used to develop attainment year boundary conditions for the corresponding local episode because Run 5 boundary conditions were not available when VADEQ performed their future year modeling. Run 5 emissions most closely represent the the emission budgets in the NOx SIP call final rule. A comparison was made between ozone concentrations predicted by Run I and Run 5 . Attachment 4 of this TSD contains plots containing peak ozone concentrations for July 20, 1991 for Run I and Run 5. July 20, 1991 is the primary episode day for the July 18-20, 1991 episode. The peak concentration plots from Run I and Run 5 are virtually indistinguishable, which suggests that the boundary

conditions produced by each of these runs are very similar. The meteorological fields were primarily developed through application of the Diagnostic Wind Model (DWM) developed by System Application International (SAI) as part of the UAM-IV modeling system.

III.D. Base Year Emissions

Base year emissions were provided by the individual states covered by the modeling domain. In cases where a state did not have the appropriate inventory information, VADEQ relied heavily on the emissions inventories developed in the OTAG process. VADEQ performed extensive quality assurance checks on the emissions data to ensure consistency and accuracy of these data from one state to another. EPS 2.0 and EMS-95 were used to grid and speciate state provided emission inventories.

III.E. Model Performance

In general, the UAM-IV modeling does an adequate job representing the distribution of ozone concentrations in the area. However, the local modeling for the D.C. area over-predicts ozone concentrations. The local 1991 base case modeling predicts peak concentrations in the D.C. area of 167-198 ppb while ozone monitors in the same area during the same time period show peak concentrations ranging from 132 ppb to 178 ppb. This indicates that the model is over-predicting the actual ozone concentrations by an average of 19 % for the July 15-16, 1991 and July 19-20 episodes. The degree to which the peak predicted values exceed the measured values in the same general vicinity, indicates that the model is systematically over-predicting while adequately representing the spacial distribution of ozone. The base case model performance for both of the July 1991 episode show good alignment of the modeled ozone plume in comparison to monitored ozone values. Model predicted peak concentrations and monitored peak concentrations are generally paired in space. This suggests that the peak concentration over-prediction is most likely real and not due to model-predicted peaks in an unmonitored area that may be truly experiencing high ozone concentrations. Model performance statistics are within the ranges deemed acceptable by EPA (see Tables 3-4 and 3-6 on pages 3-12 and 3-20 of the Washington D.C. are submittal entitled **Modifications to the State Implementation Plan Revision, Phase II Attainment Plan for the Washington DC-MD-VA Area, February 4, 1999**)

III.F. Attainment Year Modeled Emissions and Control Measures

Attainment year emission inventories were developed through the use of Bureau Economic Analysis (BEA) growth factors for area source (VOC & NOx) and point source (VOC) growth. EGAS growth factors were used for off-road mobile source (VOC & NOx) and point source (NOx) emission projections. The on-road mobile emissions were projected by transportation modeling techniques using Mobile 5a. EPS-2 was used to grid and speciate emissions for the July 1988 and the July 1991 episodes respectively. Column three of Table III.F-1 represents the percentage reduction in emissions from the 1990 levels expected in the National Capital

interstate nonattainment area. The percentage reduction takes into account growth as well as emission reductions from measures adopted since 1990.

Table III.F-1 - National Capital Area Emissions (tons/day)

Pollutant	1990	1999	% Reduction in 1999
NOx	729	538	26
VOC	528	360	32

Tables III.F-2a through F-2c below provide the status of each control measure identified by the District of Columbia, Maryland and Virginia in the DC-MD-VA Phase II Plan.

These tables show the state adoption date of the measure, the implementation and/or compliance date of the measure and the approval status of the measure. EPA has previously analyzed the control measure strategies presented in the DC-MD-VA plan for effectiveness, enforceability and approvability. More information on each jurisdictions strategies can be found in the individual rulemaking dockets associated with EPA's SIP approvals of the underlying regulations and other SIP planning documents such as the rate-of-progress plans for the National Capital nonattainment area.

Table III.F-2d below shows the adoption and approval status of other Clean Air Act requirements applicable in the Washington area.

Table III. F-2a - District of Columbia Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day[4]	
					VOC	NOx
On-Road and Non-Road Mobile Source Controls						
Enhanced Inspection & Maintenance	state	yes	October 1997	Full approval June 11, 1999, 64 FR 31498	5.8	2.6
Federal Motor Vehicle Control program (Tier I)	federal	yes	beginning MY[5] 1994	federal rule (40 CFR 86)	1.3	2.3
Federal Motor Vehicle Control program (Tier 0)	federal	yes	pre-1990	federal rule (40 CFR 86)	N.Q.	N.Q.
Reformulated Gasoline (Phase 1)[6]	state opt-in	yes	January 1995	Approved Opt-in to federal program (40 CFR 80 subpart D)	2.2[7]	0.0
Federal Non-road Heavy Duty diesel engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 89 subpart A)	0.0	0.4
Federal Small Gasoline Engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 90 subpart A)	0.9	(-0.1)

[4] The reductions are relative to the "1999 uncontrolled emissions" which is a projection of emissions in 1999 that reflect the implementation of no new controls measures after 1990. The effects of measures in place before 1990 are reflected in this 1999 "uncontrolled" projection.

[5]Model Year (MY)

[6] Reduction bebefits are beyond those achieved by federal Phase 2 Reid Vapor Pressure requirements that took effect in 1992.

[7] Includes benefits in on-road and non-road vehicles, and refueling benefits.

Stationary Point and Area Source Controls						
NOx RACT	state	yes	May 1995	proposed conditional limited approval February 25, 1999 [64 FR 9272]		2.1
Stage II Vapor Recovery & On-roard Refueling Vapor Recovery (ORVR)	state federal	yes yes	1985 MY 1998	SIP approval pending - Direct Final Rule 64 FR 57777, October 27, 1999 federal rule (40 CFR 86)	0.0	--
Architectural & industrial maintenance coatings	federal	yes	September 1999	federal rule (40 CFR 59 subpart D)	1.6	
Consumer & commercial products	federal	yes	December 11, 1998	federal rule (40 CFR 59 subpart C)	0.6	
Autobody refinishing	federal	yes	January 11, 1999	federal rule (40 CFR 59 subpart B)	0.5	
Surface Cleaning/degreasing	state	yes	May 1, 1999	SIP approval pending - Direct Final Rule 64 FR 57777, October 27, 1999	0.1	
Graphic Arts Controls (Lithographic Printing)	state	yes	May 1, 1999	SIP approval pending - Direct Final Rule 64 FR 57777, October 27, 1999	0.6	
Additional NOx Control Beyond RACT/OTC NOx MOU Phase 2	state	no		Not submitted.		1.8

Table III. F-2b - State of Maryland Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
					VOC	NOx
On-Road and Non-Road Mobile Source Controls						
Enhanced Inspection & Maintenance	state	yes	October 1997	Direct final Rulemaking -- Full approval - 64 FR 58340, October 29, 1999	22.7	16.6
Federal Motor Vehicle Control program (Tier I)	federal	yes	beginning MY 1994	federal rule (40 CFR 86)	5.2	15.7
Federal Motor Vehicle Control program (Tier 0)	federal	yes	pre-1990	federal rule (40 CFR 86)	N.Q.	N.Q.
Reformulated Gasoline (Phase 1)[8]	state opt-in	yes	January 1995	Approved Opt-in to federal program (40 CFR 80 subpart D)	9.3[9]	0.0
Transportation Control Measures (TCM)	state	yes	July 1993	Adopted -- Part of Post-1996 plan.	0.1	0.2
Federal Non-road Heavy Duty diesel engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 89 subpart A)		3.7
Federal Small Gasoline Engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 90 subpart A)	6.3	(-0.4)
Stationary Source Controls						

[8] Reduction benefits are beyond those achieved by federal Phase 2 Reid Vapor Pressure requirements that took effect in 1992.

[9] Includes benefits in on-road and non-road vehicles, and refueling benefits.

Table III. F-2b - State of Maryland Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
NOx RACT	state	yes	May 1995	conditional limited approval proposed February 18, 1999 [64 FR 8034]		67.9
Stage II Vapor Recovery & On-board Refueling Vapor Recovery (ORVR)	state federal	yes yes	January 1993 MY 1998	SIP approved 6/9/94 59 FR 29730 Promulgated at 40 CFR 86	8.9[10]	
Stage I Vapor Recovery Enhancement	state	yes	April 26, 1993	SIP approved January 6, 1995, 60 FR 2018.	0.8	
Commercial Bakery Ovens	state	yes	July 3, 1995	SIP approved October 15, 1997 [62 FR 53544]	N.Q.	
Expanded State Point Source Regulations to 25 tons/year	state	yes	yes			
Screen Printing	state	yes	June 5, 1995	SIP approved October 15, 1997 [62 FR 53544]	N.Q.	
Architectural & industrial maintenance coatings	federal	yes	September 1999	federal rule (40 CFR 59 subpart D)	6.6	
Consumer & commercial products	federal	yes	December 11, 1998	federal rule (40 CFR 59 subpart C)	2.2	
Autobody refinishing	state	yes	July 1, 1995	SIP approved August 4, 1997 [62 FR 41853]	3.2	

[10] State only provided aggregate reduction benefits for both programs.

Table III. F-2b - State of Maryland Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
Surface Cleaning/degreasing	state	yes	June 5, 1995	SIP approved August 4, 1997 [62 FR 41853]	1.2	
Graphic Arts Controls (Lithographic Printing)	state	yes	January 1, 1992	SIP approved September 2, 1997 [62 FR 46199]	1.0	
Municipal Landfills	state	yes		State §111(d) plan approved.	1.2	
OTC NOx MOU Phase 2	state	yes	May 1999	proposed approval 1/26/99 [64 FR 3906]		68.2
Open Burning Ban	state	yes	May 1995	SIP approved January 31, 1997, 62 FR 8380.	3.6	0.8

Table III. F-2c - Commonwealth of Virginia Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
					VOC	NOx
On-Road and Non-Road Mobile Source Controls						
Enhanced Inspection & Maintenance	state	yes	October 1997	SIP approved September 1, 1999 [64 FR 47670]	24.0	15.3
Federal Motor Vehicle Control program (Tier I)	federal	yes	June 1991	federal rule (40 CFR 86)	5.3	12.1
Federal Motor Vehicle Control program (Tier 0)	federal	yes	pre-1990	federal rule (40 CFR 86)	N.Q.	N.Q.
Reformulated Gasoline (Phase 1)[11]	state opt-in	yes	January 1995	Approved Opt-in to federal program (40 CFR 80 subpart D)	9.5[12]	0
Transportation Control Measures (TCM)	state	yes	July 1993	Adopted -- Part of Post-1996 plan.	0.1	0.2
Federal Non-road Gasoline Engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 89 subpart A)	6.8	(-0.5)
Federal Non-road Heavy Duty diesel engine standards	federal	yes	beginning MY 1996	federal rule (40 CFR 90 subpart A)	0	3.2
Stationary Source Controls						
NOx RACT	state	yes	May 1995	SIP conditional limited approval proposed April 28, 1999 [64 FR 22789]	0	12.0

[11] Reduction benefits are beyond those achieved by federal Phase 2 Reid Vapor Pressure requirements that took effect in 1992.

[12] Includes benefits in on-road and non-road vehicles, and refueling benefits.

Table III. F-2c - Commonwealth of Virginia Control Measures in the 1-Hour Ozone Attainment Plans for the Metropolitan Washington Nonattainment Area						
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
Non-CTG RACT to 50 tpy	state	yes	May 1995	SIP Approved March 12, 1997 (62 FR 11332)	0.6	0
Expanded State Point Source Regulations to 25 tons/year	state	yes	May 1995	SIP Approved March 12, 1997 (62 FR 11332)	0.3	0
Stage II Vapor Recovery & On-roard Refueling Vapor Recovery (ORVR)	state federal	yes yes	January 1993 MY 1998	SIP approved 59 FR 32353, June 23, 1994 Promulgated at 40 CFR 86	7.9[13]	0
AIM Surface Coatings	federal	yes	September 1999	federal rule (40 CFR 59 subpart D)	5.6	0
Consumer & commercial products	federal	yes	December 11, 1998	federal rule (40 CFR 59 subpart C)	1.9	0
Autobody refinishing	federal	yes	January 11, 1999	federal rule (40 CFR 59 subpart B)	2.8	0
Surface Cleaning/Degreasing	state	yes	June 1995	SIP approval pending - Direct Final Rule 64 FR 59635, November 3, 1999	1.6	0
Municipal Landfills	state	yes	December 1995	Federal rule November 8, 1999, 64 FR 60689	1.1	0
Open Burning Ban	state	yes	May 1995	SIP Approved March 12, 1997 (62 FR 11334)	2.6	0.6
Stage I Vapor Recovery	state	yes		SIP Approved June 23, 1994	0.9	0

[13] State only provided aggregate reduction benefits for both programs.

Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reduction by 1999 tons/day	
Graphic Arts	state	yes	May 1995	SIP approved March 12, 1997 (62 FR 11334)	1.5	0

TABLE III.F-2d -- OTHER CLEAN AIR OZONE SIP REQUIREMENTS APPLICABLE IN THE WASHINGTON NONATTAINMENT AREA

Name of Control Measure	Type of Measure	Included in Local Modeling	Approval Status
Clean Fuel Fleets (CFF) or substitute	CAA SIP Requirement	No	NLEV SIP submitted as a CFF substitute - Maryland & Virginia CFF SIP approval pending - the District
National Low Emission Vehicle (NLEV)	State opt-in	No	Federal program promulgated at 40 CFR 86 subpart R. State opt-in SIP approval pending - Maryland & Virginia the District will submit by 2/15/2000.
New Source Review	CAA SIP Requirement	N/A	Virginia: Final approval published September 21, 1999. The District Final approval published July 31, 1997. Maryland - Proposed approval published May 25, 1994.
Base Year Emissions Inventory	CAA SIP Requirement	N/A[1]	Maryland, Virginia & the District: SIP approved see 63 FR 36864, July 8, 1998.
15% VOC Reduction Plan	CAA SIP Requirement	Yes[2]	SIP approved - the District see 64 FR 42629, August 5, 1999. SIP approval pending - Maryland & Virginia
9% rate of progress plan	CAA SIP Requirement	Yes[2]	SIP approval pending - Maryland, Virginia & the District
Emissions Statements	CAA SIP Requirement	N/A	SIP approved - Maryland, Virginia & the District

Photochemical Assessment Monitoring System (PAMS)	CAA Requirement	N/A	Maryland, Virginia & the District: SIP approval published September 11, 1995.

[1] Does not produce emission reductions.
[2] The measures used to demonstrate rate of progress were modeled.

Table III. F-3a - Additional Control Measures Contributing to Attainment of the 1-Hour Ozone NAAQS in the Metropolitan Washington Nonattainment Area in 1999

Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reductions by 1999 tons/day		Reductions by 2005 tons/day	
					VOC	NOx	VOC	NOx
On-Road and Non-Road Mobile Source Controls								
Federal Controls on Large Municiapl Waste Combustors in VA	federal	11/12/98	1999	Promulgated see 63 FR 63191	0	4.2		
NLEV in VA and MD	state	yes	beginning MY 1999	SIPs submitted 3/99, approval pending	1.9	1.8	**	**

Table III. F-3b - Additional Control Measures Contributing to Attainment of the 1-Hour Ozone NAAQS in the Metropolitan Washington Nonattainment Area in 2005

Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reductions by 1999 tons/day		Reductions by 2005 tons/day	
					VOC	NOx	VOC	NOx
On-Road and Non-Road Mobile Source Controls								
Marine Engine Standards	federal	yes	beginning MY 1998	federal rule	0	0	**	**
Railroad Engine Standards	federal	yes	2000	federal rule	0	0	**	**
Heavy Duty Diesel Engines (On-road)	federal	yes	beginning MY 2004	federal rule 10/97	0	0	**	**

Table III. F-3b - Additional Control Measures Contributing to Attainment of the 1-Hour Ozone NAAQS in the Metropolitan Washington Nonattainment Area in 2005								
Control Measure	Type of Measure	Adopted	Implemented	Approval Status	Reductions by 1999 tons/day		Reductions by 2005 tons/day	
Reformulated Gasoline - Phase 2	state	yes	January 1, 2000	Approved Opt-in to federal program (40 CFR 80 subpart D)	0	0	**	**
NLEV in MD, VA	state	yes - MD, VA	beginning MY 1999, ending MY2003	pending	1.9*	1.8*	**	**
Tier 2 FMVCP	federal	pending	beginning MY 2004 if promulgated by 12/31/1999	federal promulgation pending	0	0	0.86***	6.8***

* Area-Wide benefits from "Revised State Implementation Plan (SIP) Revision, Phase I Attainment Plan" which was submitted by the District, Maryland and Virginia on May 25, 1999, May 20, 1999 and May 25, 1999, respectively. This plan revised the 1999 emission reduction estimates for the post-1996 rate-of-progress plan; the revised estimates included NLEV.

**Credit from this measure was assumed in the regional modeling conducted for the NOx SIP Call. Actual emission reductions are presently being calculated.

***From Memorandum, "1-Hour Ozone Attainment Demonstrations and Tier 2/Sulfur Rulemaking" from Lydia Wegman, Office of Air Quality Planning and Standards and Merrylin Zaw-Mon, Office of Mobile Sources to the Air Division Directors, Regions I-VI, issued November 8, 1999. A copy of this memorandum may be found on EPA's web site at http://www.epa.gov/ttn/oarpg/t1pgm.html

Inside the Baltimore-Washington modeling domain, the States modeled only the measures indicated in Table III.F-2a through III.F-2c. These measures comprised the post-1996 rate-of-progress plan plus an additional level of control beyond RACT (the OTC NOX MOU Phase 2) at large stationary sources of NOx in the District's and Maryland's portion of the Washington area. These are the measures listed in Tables III.F-2a through III.F-2c. The States did not model EPA's NOx SIP call within the domain but assumed boundary conditions consistent with EPA's NOx SIP call.

The post-1996 plan provided for emissions levels of 359.7 tons per day (TPD or tpd) of VOC and 608.3 TPD of NOx. The attainment modeling included a further 68.2 and 1.8 TPD of NOx reduction from major stationary sources in Maryland's and the District's portions of the area. This results in a modeled NOx inventory for the nonattainment area of 538.3 TPD NOx.

Maryland, Virginia and the District have submitted all CAA mandated measures, though many but not all of these measures have been approved to date. EPA is proposing approval of the attainment demonstrations for the Washington area contingent upon issuance of a SIP approval of all CAA required measures and other attainment measures before final approval is issued for the attainment demonstration.

The District has not submitted an adopted rule for the 1.8 TPD of NOx reduction from major stationary sources of NOx reduction beyond RACT. However, Maryland and Virginia have submitted SIP revisions for an opt-in to the NLEV program. NLEV was not included in the local modeling. Maryland and Virginia have quantified that this measure will provide 1.8 TPD of NOx (plus 1.9 TPD of VOC) reductions in the Washington area by 1999 in their Post-1996 plans submitted on May 20 and May 25,1999, respectively. Refer to dockets MD094 and VA100. Collectively, the three Washington area States have provided adopted rules for all the reductions modeled in the attainment demonstration. EPA believes it is reasonable to propose to approve the attainment demonstrations and attainment date extension requests for the Washington area provided that the States adopt and submit sufficient measures to demonstrate that 2005 emissions will be less than or equal to the 1999 control strategy levels. Howwever, to be consistent with EPA's framework, the District must adopt and submit this measure before EPA can approve the attainment demonstration.

The Virginia attainment demonstration included a commitment to 23.0 TPD of NOx reductions beyond RACT and beyond that contained in the local modeling. The schedule for implementation for this measure provided in Commonwealth's attainment demonstration SIP is is past (1998) (refer to section 8.2, page 8-10 of the plan), and thus, EPA can not propose approval of this commitment as part of this action. However, because this measure was not included in the local modeling, under the framework for approval discussed, EPA believes that the lack of an adopted rule for this measure does not preclude proposing approval of the Virginia and other State's attainment demonstrations for the Washington area. EPA is proposing to approve the attainment demonstrations and attainment date extension requests for the Washington area provided that: Virginia can demonstrate that this rule is not required to

demonstrate that 2005 emissions will be less than or equal to the 1999 control strategy levels (a demonstration that the rule is not required must accompany an adequate conformity budget), or, Virginia must submit a revised commitment and adopted rule in time to allow EPA to determine the conformity bduget adequate and approve the attainment demonstration, respectively.

III.G. Attainment Year Modeling

Due to time constraints and resource limitations, attainment year modeling was performed for two episodes, July 15-16, 1991 and July 18-20, 1991. EPA modeling guidance requires that a least three episodes should be modeled from at least two meteorological regimes conducive to high ozone concentrations. The two episodes modeled in the D.C. area represent very severe ozone events with meteorological ozone forming potential rankings of less than 80 out of all days over the last fifty years (Cox and Chu 1996). The Cox and Chu analysis ranked all summer days over the past fifty years according to their meteorological ozone forming potential. The most severe day would receive a ranking of one. Given the severity of these episodes, they are likely to be the controlling episodes in the National Capital area in the determination of emission reductions needed for attainment. These episodes also represent the meteorological regime most frequently responsible for elevated ozone concentrations in the Washington D.C. area (see section II.B. Episodes)..

The attainment year modeling was performed with UAM-IV and adhered to the requirements outlined in the document entitled, **Guideline for the Regulatory Application of the Urban Airshed Model, EPA-450/4-91-013.** This modeling included 1999 controlled emissions reflective of the emission reductions presented in Section III.F. of this TSD. OTAG Run I boundary conditions were used in the modeling along with wind fields that were developed through application of the Diagnostic Wind Model (DWM).

For the July 15-16, 1991 and July 18-20, 1991 episodes, modeled peak ozone concentrations are reduce by an average of approximately 22 ppb once controls in the Phase II plan are applied. The modeling results from July 15 and July 18 are model ramp-up days and were not used to calculate average ozone reduction. When the average modeled ozone reduction is applied to the peak measured concentration for July 16 (137 ppb) and July 19 (132 ppb), the resulting concentrations are 115 ppb and 110 ppb respectively. This would indicate attainment for these days. However, when the modeled ozone reduction is applied to the peak monitored level on July 20 (178 ppb), the resulting concentration is 156 ppb. Because the Cox-Chu ozone forming potential rank (Cox-Chu 1996) is very high for July 20, 1991 (13th most severe day out of approximately the last 50 years with an average reoccurrence of once every 4-5 years) this type of day is not likely to occur often enough to be a major causative factor for nonattainment, especially since the emission controls modeled in this plan should eliminate ozone exceedances for all but the most meteorologically severe days.

Following the screening test defined in the proposed Guidance 8-hour ozone modeling guidance entitled **Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS, May 1999** the local modeling results presented table below are used to calculate a "relative reduction factor" (RRF) and project a domain wide "future design value". The episodes modeled were July 15-16, 1991 & July 18-20, 1991 and the 1989-1991 observed air quality design value is 134 ppb. July 15 and 18, 1991 were excluded from the analysis because these days were ramp-up days for each episode.

Domain maxima concentrations with predicted peak allowed based on 44 year rankings (ppb) along with percent change in predicted peak for all days modeled				
Day	Observed	Base Case Predicted	Control 1999Predicted (%change)	Peak Allowed (Ranking)
July 16, 1991	137	167	150 (10%)	130 (32)
July 19, 1991	132	168	139 (17%)	124 (>100)
July 20, 1991	178	198	178 (10%)	137 (13)
	Totals:	533	467 (37%)	
	Averages:	177	155 (12%)	

RRF=Avg. Future/Avg. Current =155/177=.88

Future design value = (Current design value for 89-91) * RRF = 136ppb * .88 = **119 ppb**

The result of the local modeling screening test is an area-wide design value that has been reduced to 119 ppb due to the application of the emission control measures contained in the DC-MD-VA plan. This result, along with local-scale modeling for both 1991 episodes that shows adjusted peak monitored levels below 124 ppb for two out of three primary episode days, warrants the examination of the weight-of-evidence (WOE) arguments presented in the following section of the TSD. The WOE arguments provide additional evidence that attainment of the ozone standard is likely for the National Capital interstate ozone nonattainment area.

H. Attainment Delay due to Transport

Boundary condition sensitivity modeling was performed for the Washington area using OTAG Base 1C and Run I boundary conditions. OTAG Base 1C boundary conditions reflect the

boundary conditions that will result from the implementation of all Clean Air Act mandated controls. OTAG Run I boundary conditions closely approximate the boundary conditions that will result from the additional emission reductions anticipated from the NOx SIP call. The Washington area model runs with OTAG Base 1C boundary conditions were compared to the runs with OTAG Run I boundary conditions. The model run with OTAG Run I boundary conditions show a 5 to 10 ppb reduction in peak ozone concentrations in areas with modeled peak concentrations above 124 ppb.

A 5 to 10 ppb increase in ozone concentrations would increase projected design values based upon local modeling over 124 ppb and would increase future predicted exceedances well beyond the range consistent with attainment. The Washington area is only able to demonstrate attainment of the 1-hour ozone standard by including in their analysis the reduction of ozone and ozone precursor transport that will result from regional NOx controls.

The local modeling for the Washington area showed that emission levels in Baltimore affect peak ozone concentrations in the Washington area on July 19, 1991, and July 16, 1991, two of three most severe episode days modeled. These changes are discussed regarding model runs S4A2b and S5A2b on pages 25 to 29 in the appendices of the submittals. The two model runs investigated the effects on ozone in the Washington portion of the Baltimore-Washington domain when additional reductions beyond the 1999 base case were implemented in the Baltimore nonattainment area portion of the domain. The Baltimore area has an attainment date of 2005 and is required to achieve additional reductions beyond the 1999 base case. The Washington area has been identified as a downwind area affected by transport from upwind areas in other States that significantly contribute to nonattainment in the Washington area and, in the case of Maryland's portion of the Washington area, from upwind area, Baltimore, in the same State with a later attainment date of 2005.

IV. Weight of Evidence

A weight of evidence determination is a diverse set of technical analyses performed to assess the confidence one has in the modeled results and to help assess the adequacy of a proposed strategy when the outcome of local scale modeling is close to attainment.

IV.A. Using Ambient Data and NOx SIP Call Modeling to Evaluate Attainment

In July of 1998, EPA recommended the use of a methodology that uses the results from modeling performed to support EPA's NOx SIP Call Supplemental Notice of Proposed Rulemaking (SNPR)[14]. This methodology uses the SNPR modeling results in a manner that better replicates the monitored attainment test. The monitored attainment test requires that the

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[14] Federal Register/Vol. 63, No. 90/Monday May 11, 1998/Proposed Rules Web Document: http://www.access.gpo.gov/su_docs/aces/aces140.html , Search federal register "SNPR"

design value recorded at each monitor in the nonattainment area be less than 125 ppb. The design value is the fourth highest 1-hour average measured ozone concentration over a period of three years.

The SNPR modeling was used by EPA to estimate the amount of ozone reductions achieved after regional NOx controls are in place. The ozone reduction estimate was determined by examining modeled ozone concentrations from three episodes (1991, 1993 and 1995) in the 1995-1996 base year period and the 2007 control case and then constructing county-specific reduction factors. A complete description of this procedure is included in Attachment 1. Reduction factors were then applied to county-specific design values for the 1994-1996 time period. The resulting ozone concentrations were then compared to the current 1-hour ozone standard used for monitoring and modeling purposes (124 ppb) to determine the likelihood of a particular county reaching attainment after the NOx SIP call controls are in place. Results from this exercise are described in a memorandum from Bill Hunt (Attachment 2). A summary document of containing the adjusted design values resulting from EPA's analysis for all of the counties with ozone monitors in the 22 state area affected by the NOx SIP call can be found in Attachment 3.

The results of EPA's rollback analysis show attainment for all of the counties in the National Capital interstate ozone nonattainment area. To provide additional information that continues to support attainment for the National Capital area, the adjustment factors developed in EPA's analysis were also applied 1997 and 1998 Washington D.C. area design values. The results presented in Table IV.A-1 show all area design values below 124 ppb.

Table IV.A-1 Adjusted Design Values for the National Capital Area Based on the NOx SIP Call SNPR Modeling

County/State	1996 Design Value (ppb)	Adjusted 1996 Design Value (ppb)	1997 Design Value (ppb)	Adjusted 1997 Design Value (ppb)	1998 Design Value (ppb)	Adjusted 1998 Design Value (ppb)
District of Columbia	133	113	125	107	118	101
Maryland						
Calvert	97	82	116	98	116	98
Charles	109	92	118	101	123	105
Montgomery	119	96	118	96	117	95
Prince George's	135	119	132	117	129	115
Virginia						
City of Alexandria	118	99	124	103	119	99
Arlington	126	107	123	105	119	102
Fairfax	120	106	124	110	119	105
Prince William	109	92	110	93	115	97
Stafford	109	92	110	93	112	95

The information in Table IV.A-1 shows that regional emission reductions required in the NOx SIP call, when paired with the National Capital area's current emission control efforts, will most likely result in the attainment of the 1-hour ozone standard for this area.

IV.B. Identification of Additional Emission Reductions Needed for Attainment

To strengthen the weight of evidence and account for high locally modeled peak concentrations, EPA developed a methodology that uses the local scale photochemical grid modeling results along with ambient air quality monitoring data to determine levels of emission reductions, beyond the reductions contained in the 1998 Phase II Plans, needed to support attainment of the 1-hour NAAQS for ozone. The EPA methodology is described in the guidance document entitled **Guidance for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled** located in Attachment 5. Attachment 5 also

contains the data sheet containing the specific information that went into the analysis for the Washington D.C. area. EPA Method 2 (see Attachment 5) was deemed most appropriate for the determination of additional emission reductions in the Washington area because it integrates the use of both modeled and monitored data. The EPA analysis shows that the Washington area does not need any additional NOx or VOC emission reductions for the area to demonstrate attainment of the ozone NAAQS.

IV.D. Adjustment of Modeled Peak Concentrations for Model Over-prediction

As discussed in the model performance section of this TSD (**Section III.C.**) UAM-IV over-predicts peak ozone concentrations for both July 1991 episodes by an average of approximately 20 %. When modeled peak concentrations are reduced by 20 %, the result is an adjusted peak concentration of 120 ppb for July 16th, 111 ppb for July 19th and 142 ppb for July 20th. The adjusted peak concentration for two out of the three primary episode days indicate attainment. The adjusted concentration for July 20th does not indicate attainment at 142 ppb. However, this result is only 5 ppb greater than the peak concentration allowed (137 ppb) on this particular episode day due to its Cox-Chu ranking of 13. Also, the probability of a day occurring with as severe an ozone forming potential as July 20, 1991 is approximately once in every 4-5 years and therefore should not occur frequently enough to cause nonattainment.

V. Summary

The ozone attainment demonstration contained in the submittal entitled, **State Implementation Plan (SIP) Revision, Phase II Attainment Plan, for the Washington DC-MD-VA Nonattainment Area , April 10, 1998** contains local scale modeling that, other than the number of episodes modeled, fulfills EPA recommended modeling procedures. Given the severe nature of the episodes modeled, even if three episodes were modeled, the two episodes that were modeled (July 15-16, 1991 & July 18-20, 1991) would probably be the controlling episodes in the determination of the emission reductions needed in the National Capital area for attainment. When the 1999 emission inventory with the control strategy is modeled, peak ozone concentration is reduced by approximately 22 ppb from the modeled peak concentrations in the 1988 and 1991 base cases. When the average modeled ozone reduction is applied to the peak measured concentration for July 16 (137 ppb) and July 19 (132 ppb), the resulting concentrations are 115 ppb and 110 ppb respectively. This would indicate attainment for these days. However, when the modeled ozone reduction is applied to the peak monitored level on July 20 (178 ppb), the resulting concentration is 156 ppb. Because the Cox-Chu ozone forming potential rank (Cox-Chu 1996) is very high for July 20, 1991 (13th most severe day out of approximately the last 50 years with an average reoccurrence of once every 4-5 years) this type of day is not likely to occur often enough to be a major causative factor for nonattainment, especially since the emission controls modeled in this plan should eliminate ozone exceedances for all but the most meteorologically severe days. When model over-prediction is accounted for in both the July 1991 episodes, the local scale modeling predicts a peak concentrations of 120

ppb for July 16th, 111 ppb for July 19th and 142 ppb for July 20th. The adjusted peak concentration for two out of the three primary episode days indicates attainment. The adjusted concentration for July 20th does not indicate attainment at 142 ppb. However, this result is only 5 ppb greater than the peak concentration allowed (137 ppb) and as discussed above, the probability of a day occurring with an ozone forming potential as severe as July 20th's is approximately once in every 4-5 years and therefore should not occur frequently enough to cause nonattainment. The local scale modeling results alone lead one to believe that attainment is likely.

The DC-MD-VA Phase II Plan provides weight-of-evidence arguments that corroborate further that it is likely the National Capital area will attain the 1-hour ozone standard by the requested extension date of 2005. EPA developed design value adjustment factors based on regional scale modeling performed for the NOx SIP call SNPR. These the adjustment factors were used to adjust the1994-1996 area design values. The analysis showed all area adjusted design values below the level needed for attainment (124 ppb). To provide additional information, the EPA's design value adjustment factors were applied to the 1995-1997and 1996-1998 area design values, again resulting in all area design values below 124 ppb. A design value rollback analysis was also performed using the local modeling results. The outcome of this analysis showed an adjusted area-wide design value of 119 ppb.

Because the Washington D.C. area local modeling showed some peak concentrations above levels deemed consistent with attainment, EPA conducted an analysis to determine what additional emission reductions may be needed to support ozone attainment in the D.C. area. The EPA analysis determined that the Washington area does not need any additional emission reductions beyond those contained the area Phase II plan to ensure attainment of the ozone NAAQS.

Based on the results of the local scale modeling along with the additional weight-of-evidence arguments provided in the DC-MD-VA Phase II plan, EPA believes that attainment of the 1-hour ozone standard has been successfully demonstrated for the National Capital area by the requested extension date of 2005.

VI. Comparison of the State Submittals Against the Framework for Approval:

A. NOx reductions consistent with the modeling demonstration

Collectively the three States have provided for enough emission reductions by 1999 with local measures that are consistent with the local modeling. The District has not adopted a rule for beyond RACT NOx reductions. Maryland and Virginia however have adopted an NLEV SIP which was not included in the local modeling and which achieves aggregate reductions of 1.8 TPD of NOx reduction and 1.9 TPD of VOC reduction in the Maryland-Virginia portion of the nonattainment area.

B. CAA measures and measures relied on in the current SIP submission
The States have submitted all CAA mandated measures, though many but not all of these measures have been approved to date. EPA is proposing approval of the attainment demonstration for the Washington area contingent upon issuance of a SIP approval of all CAA required measures and other attainment measures before final approval is issued for the attainment demonstration. The District has adopted and submitted a Clean Fuel Fleets SIP which was not included in the local modeling. In a December 16, 1998 letter, the District requested the use of NLEV as a substitute for CFF. EPA cannot act on the December 16, 1998 request because EPA has not received an NLEV SIP from the District. adopted.

C. Motor vehicle emissions budget
EPA has determined that the budgets are inadequate because there is no budget for 2005, enhanced I/M program parameters used do not match the current enhanced I/M SIPs and that additional measures may be needed to offset growth to 2005.

The EPA has found that the motor vehicle emissions budgets in the attainment demonstrations for the Washington area submitted by Maryland, Virginia and the District are inadequate for conformity purposes.

On October 26, 1999, Judith M. Katz, Director, Air Protection Division, EPA, Region III, sent a letter to Ms. Ann Marie DeBiase, Director, Air and Radiation Management Administration, Maryland Department of the Environment; Mr. Donald Wambsgans, Program Manager, District of Columbia Department of Health, Air Quality Division and Mr. John Daniel, Director, Air Program Coordination, Virginia Department of Environmental Quality indicating that the motor vehicle emissions budgets in their attainment demonstrations were not adequate for conformity purposes.

The motor vehicle emission budgets in the demonstrations for the Washington area were not found adequate because they did not meet all the adequacy requirements in the conformity rule. See 40 CFR 93.118(e)(4). EPA made this determination for the following reasons: the budget was inconsistently identified; the budget was based upon outdated enhanced I/M control parameters; and there is no budget for the requested extension year of 2005. The following paragraphs provide a summary of each of these findings, of the corrective action required and of EPA's proposed action.

1. Inconsistent Identification:
The motor vehicle emissions budget are not clearly identified and precisely quantified as required by 40 CFR 93.118(e)(4)(iii). One portion of the attainment demonstration SIP submission shows the area's 1999 budget in total tons per day is: 196.8 tons per day for VOC and 123.5 tons per day for NOx. However in another portion of the attainment demonstration SIP, the motor vehicle emissions budget is identified as 199.2 tons per day for VOC and 123.3 tons per day for NOx. In Tables 4-11 and 4-12 on page 4-15 of the submittal present 1999 controlled emissions levels broken down by Mobile, point, nonroad and area source sectors. The 1999 control emissions

differ from the budgets presented in section 8.1.1 on page 8-2 of the plan.

2. Outdated Enhanced I/M program Parameters:
The current motor vehicle emissions budget is inadequate because the budget was set assuming parameters inconsistent with the current enhanced I/M programs and thus is not consistent with the control measures in the submitted SIP revisions as required by 40 CFR 93.118 (e)(4)(iv).

3. No Budget for 2005:
The motor vehicle emissions budget when considered together with all other emissions sources are not consistent with applicable requirements for attainment by 2005 as required by 40 CFR 93.118 (e)(4)(iv). The States have requested an attainment date extension to 2005 but the attainment demonstrations for the Washington area do not contain an adequate motor vehicle emissions budget for 2005.

Before EPA can fully approve the attainment demonstration and attainment date extension to 2005, Maryland, Virginia and the District must submit SIP revisions to amend the attainment demonstrations for the Washington area that contain adequate motor vehicle emissions budget for 2005. In addition, EPA can propose, in the alternative, to disapprove the attainment demonstration SIPs for those nine areas if the Maryland, Virginia and the District do not submit motor vehicle emissions budget for the Washington area that EPA can find adequate.

A motor vehicle emissions budget is the estimate of motor vehicle emissions in the attainment year that when considered with emissions from all other sources is consistent with attainment. The attainment demonstrations for the Washington area contain levels of modeled emissions that EPA believes demonstrate attainment once transport from upwind areas is addressed. The basis for this conclusion will not be altered if the Washington area States can demonstrate that the level of nonattainment area emissions in 2005 is equal to or less than the 1999 control strategy levels contained in the attainment demonstrations considering growth. Thus, Maryland, Virginia and the District can demonstrate that revised motor vehicle emissions budgets for 2005 in an amendment to their attainment demonstrations for the Washington area are adequate by showing that overall emissions including the revised motor vehicle emissions budget when considered with emissions from all other sources are less than the 1999 control strategy levels.

Emissions generating activities generally grow over time. However, emissions levels from mobile source categories may actually decrease between 1999 and 2005 due to the effects of replacement of vehicles with older engines with new vehicles and due to the new control programs listed in Tables VI.C-3a and VI.C-3b below. Tables VI.C-3a and VI.C-3b list measures that will not and will, respectively, affect the motor vehicle emissions budget. Table VI.C-3a includes measures that were not part of the attainment demonstrations because the implementation dates are after 1999 and will contribute to attainment in 2005. Table VI.C-3b lists the measures that will contribute to attainment in 2005 and that will affect the budget and indicates if each measure was included in the 1999 motor vehicle emissions budget or in the local scale modeling. (Several of these measures could not be included in the 1999 budget because the

implementation dates are after 1999.) EPA has interpreted the general adequacy criteria with respect to the 1-hour ozone attainment demonstrations to require the motor vehicle emissions budgets to include the effects of all motor vehicle controls, including federal measures and the mobile source control measures assumed in the NOx SIP Call, that will be in place in the attainment year, or in the case of a serious area requesting an attainment date extension, in place during the requested extension year. See document number 3 under recent documents in section II.B above Therefore, the revised motor vehicle emissions budgets presumptively must include all currently promulgated federal measures and state SIP measures and opt-ins shown in Table VI.C-3b with the exception of Clean Fuel Fleets (CFF). See section IV.D. below for discussion concerning the incorporation of the proposed Tier 2 standards into the motor vehicle emissions budgets.

Virgnia and Maryland each have submitted an NLEV SIP revision as a substitute for CFF. For the Maryland and Virginia components of the motor vehicle emissions budget NLEV must be used as in lieu of CFF. The District has submitted an adopted CFF SIP, but in a December 16, 1998 letter, requested the use of NLEV as a substitute for CFF. EPA has not acted on the December 16, 1998 request because EPA has not received an NLEV SIP from the District. The motor vehicle emissions budget must include NLEV in the District's component of the revised motor vehicle emissions budget, but need not include CFF if the District submits an adopted NLEV SIP revision with the revised motor vehicle emissions budget; otherwise, the District must include CFF as well as NLEV in the District's component of the revised motor vehicle emissions budget. Because CFF is a required SIP element for serious areas, the District must provide a SIP revision consisting of an adopted NLEV program in order to replace a required SIP element.

TABLE VI.C-3a – ADDITIONAL NONROAD MOBILE SOURCE CONTROL MEASURES CONTRIBUTING TO ATTAINMENT OF THE 1-HOUR OZONE NAAQS IN THE WASHINGTON NONATTAINMENT AREA IN 2005

Name of Control Measure	Type of Measure	Included in Local Modeling	Adoption and Approval Status
Marine Engine Standards	federal	No	Promulgated at 40 CFR 91
Railroad Engine Standards	federal	No	Promulgated at 40 CFR 92

TABLE VI.C-3b -- ON-ROAD MOBILE SOURCE CONTROL MEASURES CONTRIBUTING TO ATTAINMENT OF THE 1-HOUR OZONE NAAQS IN THE WASHINGTON NONATTAINMENT AREA IN 2005

Control measure	Implementation Year	In Local Modeling demonstration?	In the 1999 motor vehicle emissions budget?
Federal Motor Vehicle Control Program (FMVCP) Tier 1 Tier 2	 1994 2004	 Tier 1 FMVCP only	 Tier 1 FMVCP only
High enhanced I/M (CAA Mandate)	1997	Yes	Yes
Reformulated Gasoline (State Opt-in) Phase I Phase II	 1995 2000	Phase I only	Phase I only
Clean Fuel Fleets (CAA Mandate)	1998	No	No
National Low Emissions Vehicles (NLEV)	1999	No	No
Federal Heavy-duty Diesel Vehicle (HDV) 2 gm std	2004	No	No

If additional emission reductions beyond those in the attainment demonstration or those listed in Tables VI.C-3a and VI.C-3b are required in 2005 to ensure 2005 nonattainment area emissions are less than the 1999 modeled emissions, then Maryland, Virginia and the District will need to submit at least a commitment for the purposes of determining the motor vehicle emissions budget adequate and rules for these measures. Any such adopted measures must provide for implementation as expeditiously as practicable, but no later than the date by which the upwind reductions needed for attainment will be achieved.

D. Tier 2/Sulfur program benefits

1. Tier 2/Sulfur program benefits

EPA concludes that based on the modeling and weight-of-evidence that Washington area would

not need any additional emission reductions beyond those contained the area attainment demonstration to ensure attainment of the ozone NAAQS by 1999. EPA also concludes that the attainment demonstrations for the Washington area collectively have sufficient local measures to have demonstrated attainment by 1999 but did not attain due to transport from other areas. However, as discussed in section IV.C above, Maryland, Virginia and the District must amend the attainment demonstrations to include an adequate conformity budget for 2005.

The EPA issued a memorandum that provides estimates of the emissions reductions associated with the Tier 2/Sulfur program proposal. See number 4 under "Recent Documents" section II.B The memorandum provides the tonnage benefits for the Tier 2/Sulfur program in 2007 on a county-by-county basis for all counties within 10 serious and severe nonattainment areas and the 2005 tonnage benefits for the Tier 2/Sulfur program for each county for three areas including the Washington area.

The EPA also issued a memorandum which explains the connection between the Tier 2/Sulfur program, motor vehicle emissions budgets for conformity determinations, and timing for SIP revisions to account for the Tier 2/Sulfur program benefit. See item number 3 under "Recent Documents" in section II.B above. This memorandum explains that conformity analyses in serious and severe ozone nonattainment areas can begin including Tier 2/Sulfur program benefits once EPA's Tier 2 rule is promulgated, provided that the attainment demonstration SIPs and associated motor vehicle emissions budgets include the Tier 2 benefits. For areas that require all or some portion of the Tier 2 benefits to demonstrate attainment but have not yet included the benefits in the motor vehicle emissions budgets, EPA's adequacy finding will include a condition that conformity determinations may not take credit for Tier 2 until the SIP budgets are revised to reflect Tier 2 benefits. See EPA's memorandum for more information.

States that need to rely in whole or in part on the Tier 2 benefits to help demonstrate attainment will need to adjust the demonstration for their SIP submission, emission inventories and motor vehicle emissions budgets to include the Tier 2/Sulfur program reductions in order for EPA to approve the SIP submittal. The submittal requirement including the analysis to make that submission is described in the two memoranda cited. States may use the tonnage benefits and guidance in these memoranda to make these adjustments to the SIP submission and motor vehicle emission budgets.

A number of areas will be taking a partial credit for Tier 2 if they use credit from national low emissions vehicles (NLEV) in their attainment demonstration. These nonattainment areas include the Metropolitan Washington, D.C. areas. By regulation, the NLEV standards do not extend beyond the 2003 model year unless EPA promulgates Tier 2 vehicle standards at least as stringent as the NLEV standards. See 40 CFR 86.1701-99(c). Thus, the emission reductions relied upon from 2004 and later model year NLEV vehicles will actually be due to the promulgation of the Tier 2 standards, either through the extension of the NLEV program or a portion of the reduction from vehicles meeting the Tier 2 standards.

If the motor vehicle emissions budget reflects Tier 2/sulfur reductions, then like all the other SIPs that rely on Tier 2 reductions in order to demonstrate attainment, the attainment demonstration must be revised to estimate the effects of Tier 2 according to our policy before EPA can take final action approving such attainment demonstrations. Until the SIPs are revised to include full Tier 2 credit, EPA can determine that a motor vehicle emissions budget is adequate if the budget would be otherwise adequate. No conditions need be placed on such adequacy determinations if the budgets in such SIPs already include reductions equivalent to the amount of emission reductions the areas will be relying on from Tier 2 by virtue of the NLEV reductions included in the budgets. The Washington area falls into this latter category.

2. Revisions to the Motor Vehicle Emissions Budget and the Attainment Demonstration When EPA Issues the MOBILE6 Model:

Within one year of when EPA issues the MOBILE6 model for estimating mobile source emissions which takes into account the emissions benefit of EPA's Tier 2/Sulfur program, States will need to revise their motor vehicle emissions budgets in their attainment demonstration SIPs if the motor vehicle emissions budgets include the effects of Tier 2 the Tier 2/Sulfur program. In addition, the budgets will need to be revised using MOBILE6 in those areas that do not need the Tier 2/Sulfur program for attainment but decide to include its benefits in the motor vehicle emissions budget anyway. The EPA will work with States on a case-by-case basis if the new emission estimates raise issues about the sufficiency of the attainment demonstration.

States described in the paragraph above will need to submit an enforceable commitment in the near term to revise their motor vehicle emissions budget if the budgets include the effects of the Tier 2/sulfur program within one year after EPA's release of MOBILE6. This commitment should be submitted to EPA along with the other commitments discussed elsewhere in this document, or alternatively, as part of the SIP revision that modifies the motor vehicle emission inventories and budgets to include the Tier 2/Sulfur program benefits needed in order for EPA to approve the SIP submittal. For purposes of conformity, the State needs a commitment that has been subject to public hearing. If the State has submitted a commitment that has been subject to public hearing and that provides for the adoption of all measures necessary for attainment, the State should submit a letter prior to December 31, 1999, amending the commitment to include the revision of the budget after the release of MOBILE6.

The motor vehicle emissions budget for the Washington area will need to be revised. The Washington area is expected to fall in the category of States that may need to use some or all of Tier 2/Sulfur credit to ensure 2005 nonattainment area emissions are less than or equal to the 1999 modeled emissions levels. Therefore, if such Tier 2 reductions are incorporated into the motor vehicle emissions budgets for any purpose the States will have to provide an enforceable commitment to redo the motor vehicle emissions budgets after EPA releases the MOBILE6 model.

E. Additional measures to Further Reduce Emissions

EPA has concluded that the attainment demonstrations for the Washington area collectively have sufficient local measures to have demonstrated attainment by 1999 but did not attain due to transport from other areas. EPA has not identified that the attainment demonstration requires any additional reductions to further reduce emissions. As noted in section VI.C above the area may or may not need measures beyond those in the plan in order to demonstrate that the revised conformity budget is adequate(i.e., show that 2005 emissions are less the modeled 1999 control strategy level).

F. Mid-course review

None of the three Washington area States has submitted an enforceable commitment to a mid-course review. Therefore, EPA must receive an enforceable commitment to a mid-course review from each of the three Washington area States before their attainment demonstrations can be approved.

G. . Attainment Date Delays Due to Transport

The Washington area has been identified as a downwind area affected by transport from upwind areas in other States that significantly contribute to nonattainment in the Washington area and, in the case of Maryland's portion of the Washington area, from upwind area, Baltimore, in the same State with a later attainment date of 2005.

Maryland, Virginia and the District have adopted all local measures required under the area's current classification.

The Washington area attainment demonstrations and attainment date extension request will be approvable once:

1) Maryland, Virginia and the District adopt and submit adequate conformity budgets for 2005 as discussed in section II.C.3 and II.C.4 above, and

2) Maryland, Virginia and the District adopt and submit and EPA has approved adopted additional local measures (which must require implementation as expeditiously as practicable, but no later than the date by which the upwind reductions needed for attainment will be achieved), if any, needed to demonstrate that emissions in 2005 will not exceed the projected emissions for 1999, and

3) Maryland, Virginia and the District adopt and submit the enforceable commitments discussed in Table 2 of section I.D of this document.

H. Commitments to Measures Needed to Attain the 1-Hour Ozone NAAQS

Maryland, Virginia and the District each has previously committed to adopting additional control measures as necessary to attain the one-hour ozone NAAQS. The District, Maryland, Virginia made these commitments as part of SIP revisions that were submitted on November 3, 1997, December 24, 1997 and December 19, 1997, respectively (as part of the phase I submittals). EPA believes for the purposes of determining the motor vehicle emissions budget adequate that

Maryland, Virginia and the District each already has a commitment to adopt any needed additional measures, but we need reaffirmation by letter from the District, Maryland and Virginia that the intent of the existing commitment meets all the various requirements of our framework namely:

(1) For purposes of conformity and any additional measures to offset growth when demonstrating that emissions in 2005 will not exceed the modeled emissions for 1999. However, the states will need to amend/reaffirm an existing commitment by letter to provide two things concerning such additional measures:

First, the State will need to identify a list of potential control measures (from which a set of measures could be selected) that when implemented, would be expected to provide sufficient additional emission reductions to offset when demonstrating that emissions in 2005 will not exceed the modeled emissions for 1999. States need not commit to adopt any specific measures on their list at this time, but if they do not do so, they must identify sufficient additional emission reductions to attain the standard with the submitted motor vehicle emissions budget. These measures may not involve additional limits on highway construction beyond those that could be imposed under the submitted motor vehicle emissions budget. (See memorandum, "Guidance on Motor Vehicle emissions Budgets in One-Hour Ozone Attainment Demonstrations," from Merrylin Zaw-Mon, Office of Mobile Sources, to Air Division Directors, Regions I-VI.) States may, of course, select control measures that do impose limits on highway construction, but if they do so, they must revise the budget to reflect the effects of specific, identified measures that were either committed to in the SIP or were actually adopted. Otherwise, EPA could not conclude that the submitted motor vehicle emissions budget would be providing for attainment, and EPA could not find it adequate for conformity purposes.

Second, the letter should provide that the State will recalculate and submit a revised motor vehicle emissions budget that includes the effects, if any, of the measure or measures that are ultimately adopted when those measures are submitted as SIP revisions should any of the measures pertain to motor vehicles.

(2) For purposes of conformity and revising the motor vehicle emissions budget within one year of when EPA issues the MOBILE6 model for estimating mobile source emissions which takes into account the emissions benefit of EPA's Tier 2/Sulfur program: The State needs a commitment that has been subject to public hearing. If the State has submitted a commitment that has been subject to public hearing and that provides for the adoption of all measures necessary for attainment, the State should submit a letter reaffirming the commitment to include the revision of the budget after the release of MOBILE6.

(3) For purposes of conformity, the State needs a commitment that has been subject to public hearing and the commitment to perform the Mid-course Review.

If Maryland, Virginia or the District does not reaffirm that its existing commitment to adopt additional measures as necessary to reach attainment is consistent within the framework of this action, then EPA will be unable to determine the area has an adequate conformity budget.

VII. Recommendations

I recommend that EPA propose the following actions:

A. The District of Columbia

1. Proposed Approval

Propose to approve the District of Columbia's attainment demonstration SIP revision for the Washington area which was submitted on April 24, 1998 and supplemented on October 27, 1998, and to approve a request for an attainment date extension to 2005 for the Washington, if the following actions occur in accordance with our schedules:

(1) the District adopts and submits an adequate motor vehicle emissions budget.

(2) the District submits a list of control measures that, when implemented, would be expected to provide sufficient additional emission reductions to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels contained in the attainment demonstrations considering growth as discussed. The District need not commit to adopt any specific measures on their list at this time, but if they do not do so, they must identify sufficient additional emission reductions to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels with the submitted motor vehicle emissions budget. These measures may not involve additional limits on highway construction beyond those that could be imposed under the submitted motor vehicle emissions budget.

(3) the District adopts and submits a rule(s) for the regional NOx reductions consistent with the modeling demonstration, NLEV and additional emission reductions, in any, needed to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels.

(4) the District adopts and submits an enforceable commitment, or reaffirmation of existing enforceable commitment to do the following:

a) Submit measures for additional emission reductions, if any, as required to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels in the as discussed.

b) Submit a revised SIP and motor vehicle emissions budget if additional measures affect the motor vehicle emissions inventory.

c) Submit revised SIP and motor vehicle emissions budget 1 year after MOBILE6 issued.

d) Perform a mid-course review.

2. Proposed Disapproval-in-the-Alternative

Propose, in the alternative, to disapprove this SIP revision, if any of the actions listed A.1, above, do not occur.

B. State of Maryland

1. Proposed Approval

Propose to approve the State of Maryland's attainment demonstration SIP revision for the Washington area which was submitted on April 29, 1998 and supplemented on August 17, 1998, and to approve a request for an attainment date extension to 2005 for the Washington, if the following actions occur:

(1) Maryland adopts and submits an adequate motor vehicle emissions budget.

(2) Maryland submits a list of control measures that, when implemented, would be expected to provide sufficient additional emission reductions to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels contained in the attainment demonstrations considering growth. The State need not commit to adopt any specific measures on their list at this time, but if they do not do so, they must identify sufficient additional emission reductions ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels with the submitted motor vehicle emissions budget. These measures may not involve additional limits on highway construction beyond those that could be imposed under the submitted motor vehicle emissions budget.

(3) Maryland adopts and submits a rule(s) for additional emission reductions, in any, needed to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels.

(4) Maryland adopts and submits an enforceable commitment, or reaffirmation of existing enforceable commitment to do the following:

a) Submit measures for additional emission reductions, if any, as required to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels.

b) Submit a revised SIP and motor vehicle emissions budget if additional measures affect the motor vehicle emissions inventory.

c) Submit revised SIP and motor vehicle emissions budget 1 year after MOBILE6 issued.

d) Perform a mid-course review.

2. Proposed Disapproval-in-the-Alternative

Propose, in the alternative, to disapprove this SIP revision, if any of the actions listed in B.1, above, do not occur.

C. Commonwealth of Virginia

1. Proposed Approval

Propose to approve the Commonwealth of Virginia's attainment demonstration SIP revision for the Washington area which was submitted on April 29, 1998 and supplemented on August 18, 1998, and to approve a request for an attainment date extension to 2005 for the Washington, if the following actions occur:

(1) Virginia adopts and submits an adequate motor vehicle emissions budget.

(2) Virginia submits a list of control measures that, when implemented, would be expected to provide sufficient additional emission reductions to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels contained in the attainment demonstrations considering growth. The Commonwealth need not commit to adopt any specific measures on their list at this time, but if they do not do so, they must identify sufficient additional emission reductions to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels with the submitted motor vehicle emissions budget. These measures may not involve additional limits on highway construction beyond those that could be imposed under the submitted motor vehicle emissions budget.

(3) Virginia adopts and submits a rule(s) for additional emission reductions, in any, needed to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels.

(4) Virginia adopts and submits an enforceable commitment, or reaffirmation of existing enforceable commitment to do the following:

a) Submit measures for additional emission reductions, if any, as required to ensure nonattainment area emissions in 2005 are equal to or less than the 1999 control strategy levels.

b) Submit a revised SIP and motor vehicle emissions budget if additional measures affect the motor vehicle emissions inventory.

c) Submit revised SIP and motor vehicle emissions budget 1 year after MOBILE6 issued.

d) Perform a mid-course review.

2. Proposed Disapproval-in-the-Alternative

Propose, in the alternative, to disapprove this SIP revision, if any of the actions listed in C.1, above, do not occur.

REFERENCES

Cox, W.M. and S.Chu. 1996. *Assessment of Interannual Ozone Variation in Urban Areas from a Climatological Perspective.* **Atmospheric Environment**, 30, pp.2615-2625.

Guideline for Regulatory Application of the Urban Airshed Model, EPA- 450/4-91-013, July 1991.

Guidance on the Use Of Modeled Results to Demonstrate Attainment of the ozone NAAQS. EPA-454/B-95-007, June 1996.

Guidance for Implementing the 1-Hour Ozone and Pre-Existing PM-10 NAAQS, Richard D.Wilson, OAR, AA, December 1997, Memorandum.

ATTACHMENT 1.

Procedures for Estimating

the Impact of Regional Strategies

on County-Specific Ozone Design Values

Procedures for estimating the Impact of Regional Strategies on County-Specific Ozone Design Values

The following procedures were used to estimate the effects of regional strategies on 1-hr county-specific ozone design values.

Step 1: Calculate Ambient Design Values

(a) For each monitor in a county determine the monitor specific 1-hr design values by taking the 4th highest daily maximum value from ozone data collected at the monitoring site for the period 1994-1996.

(b) Select the highest design value from all monitors within the county as the county-specific design value.

Step 2: Generate Model Predictions for three OTAG Episodes (July 1991, 1993 and 1995) for the following two scenarios.

(a) Base Year model predictions reflecting emissions levels in the 1994-1996 time period.

(b) Regional Strategy model predictions reflecting a future year strategy scenario (e.g., state-specific budgets in the NO_x SIP call).

Step 3: Calculate an Adjustment Factor for each Grid Cell

Notes:

(1) The adjustment factor is based on the percent difference in ozone predictions between the Base Year and the Regional Strategy. These factors will be used in Step 5 to "rollback" ambient design values to reflect the impacts of the regional strategy.

(2) Step 3 must be followed separately for the Base Year scenario and the Regional Strategy.

For each grid cell:

(a) Calculate daily maximum ozone concentrations for every day simulated (excluding 1st two-three days of each episode) for the three OTAG episodes identified in Step 2.

(b) For each episode select the 1st, 2nd, and 3rd highest daily maximum values

(c) For each of these "ranks" (i.e., 1st, 2nd, and 3rd ranked values), average the concentrations across the episodes (e.g., sum all 1st ranked values and divide by number of episodes). This yields an average value for each rank (i.e., average of the highest concentrations, average of 2nd highest, and average of the 3rd highest values).

(d) For each of the average ranks, calculate the percent difference in ozone between the Base Year scenario and the Regional Strategy. As an example of the equation for the highest ranked value:

$$PD_1 = [(avgR_1 - avgB_1) / avgB_1]^* 100$$

Where: PD_1 is the percent difference for highest value
$avgR_1$ is the average of highest value for Regional Strategy
$avgB_1$ is the average of highest value for Base Year

This yields a percent difference in each grid for the highest, a percent difference for the 2nd highest, and a percent difference for the 3rd highest values.

(e) Calculate the mean of the percent differences (i.e., sum the percent difference calculated for the 1st, 2nd, and 3rd highest values and divide by 3)

$$ADJ_g = (PD_1 + PD_2 + PD_3) / 3$$

Where: ADJ_g is the adjustment factor for the grid cell

Step 4: Assign Grid Cell Adjustment Factors to Individual Counties

(a) A grid cell's adjustment factor is assigned to a county based on the relative portion of the grid cell area covering the county. The grid with the largest fraction of area in a county is assigned to that county.

(b) For counties that completely contain more that one grid cell, the grid cell with the highest Base Year predicted concentration is assigned to that county.

(c) The step of assigning a unique grid cell to each county yields the county-specific

adjustment factor. Note that only one grid cell is assigned to a county. Thus, there is no spatial averaging or spatial weighting of adjustment factors using multiple grid cells in determining the county-specific factors.

Step 5: Rollback Ambient Design Value

Note:

This step adjusts the ambient design values in each county to reflect the ozone reductions estimated to result from the Regional Strategy.

(a) Multiply the county-specific ambient design value, from Step 1, times the county-specific adjustment factor from Step 4, using the following equation:

$$DV_R = DV_A \times (1 + ADJ_c / 100)]$$

Where, DV_R is the design value after adjustment for the Regional Strategy,

DV_A is the ambient design value, and

ADJ_c is the adjustment factor for the county

Note: Estimates of which counties come into attainment are calculated based on a "roll-back" of county-specific Design Values. The Design Values are derived from three years of ambient measurements. The "roll-back" factors are based on the reduction in ozone (base year versus control strategy) predicted by a regional scale model during 3 ozone episodes. This information is useful for comparing the relative air quality improvements of alternative control options and for supplementing other analyses. The results may not be sufficient for an urban-scale attainment demonstration in all situations; therefore, States may choose to do additional modeling/analysis.

ATTACHMENT 2.

Bill Hunt Memorandum

INTEROFFICE MEMORANDUM

Date: 10-Jul-1998 04:21pm EST
From: BILL HUNT
RTPMAINHUB.HUNT-BILL@r3mime.r
Dept:
Tel No:

TO: See Below

Subject: NOX SIP Call for Regional Modeling to Supplement 1-Hour SIP's

** High Priority **

I am providing the Regional Air Directors for Regions 1 through 7 and their staff with information needed to complete the 1-hour SIP's. EPA has agreed that the NOX SIP call regional modeling may be used as part of the weight of evidence information to support the States selection of emissions reduction targets in the attainment demonstration. The purpose of this transmittal is to provide you and your staff with information on how to access and use these data. The website location from which the NOX SIP call data both emissions and model outputs may be downloaded through file transfer protocol (FTP) access is ftp://www.epa.gov/pub/scram001/modelingcenter/. Two files with additional information are attached to this message. The file, rollback.wpd, in WordPerfect 6.1 format, contains a description of the methodology used to interpret the impact of the modeled strategy on county-specific ambient design values. The file, 1-hour.wk4, in Lotus1-2-3 Release 5 spreadsheet format, is a listing of the 1-hour ambient county design values (1994-1996) within the regional modeling domain along with the projected change in these design values when the NOX SIP call control measures are applied.

Please share this information with your States. Feel free to call or e-mail Ellen Baldridge, if you have any questions or concerns about accessing the data and using it to supplement the States current analyses.

ATTACHMENT 3.

1994-1996 1-Hr Adjusted Design Values Based on SNPR Budget Modeling

Rev 3-6-98					
1994 - 1996 1-Hr Ambient Design Values and					
	Adjusted" Design Values Based on SNPR Budget Modeling				
FIPs				Ambient	SNPR
State	Cnty			1994-96	Budget Run
11	1	D.C.	Washington	125	107
24	3	Maryland	Anne Arundel	151	133
24	5	Maryland	Baltimore	130	111
24	9	Maryland	Calvert	97	82
24	13	Maryland	Carroll	115	93
24	15	Maryland	Cecil	139	115
24	17	Maryland	Charles	109	90
24	19	Maryland	Dorchester	117	99
24	25	Maryland	Harford	140	121
24	29	Maryland	Kent	111	95
24	31	Maryland	Montgomery	119	100
24	33	Maryland	Prince Georges	134	119
24	510	Maryland	Baltimore City	137	125
51	13	Virginia	Arlington	126	108

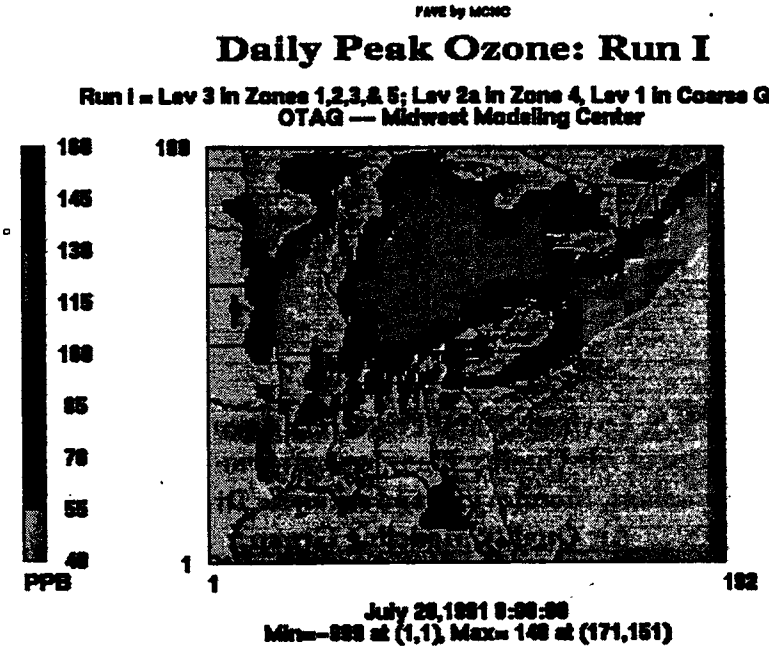
51	33	Virginia	Caroline	98	83
51	36	Virginia	Charles City	104	85
51	41	Virginia	Chesterfield	107	87
51	59	Virginia	Fairfax	120	106
51	61	Virginia	Fauquier	99	77
51	69	Virginia	Frederick	103	82
51	85	Virginia	Hanover	116	99
51	87	Virginia	Henrico	108	94
51	89	Virginia	Henry	104	84
51	113	Virginia	Madison	97	79
51	121	Virginia	Montgomery	96	78
51	147	Virginia	Prince Edward	101	78
51	153	Virginia	Prince William	109	92
51	161	Virginia	Roanoke	98	86
51	173	Virginia	Smyth	98	77
51	179	Virginia	Stafford	109	92
51	197	Virginia	Wythe	95	76
51	510	Virginia	Alexandria City	120	103

51	650	Virginia	Hampton City	100	88
51	800	Virginia	Suffolk City	104	86

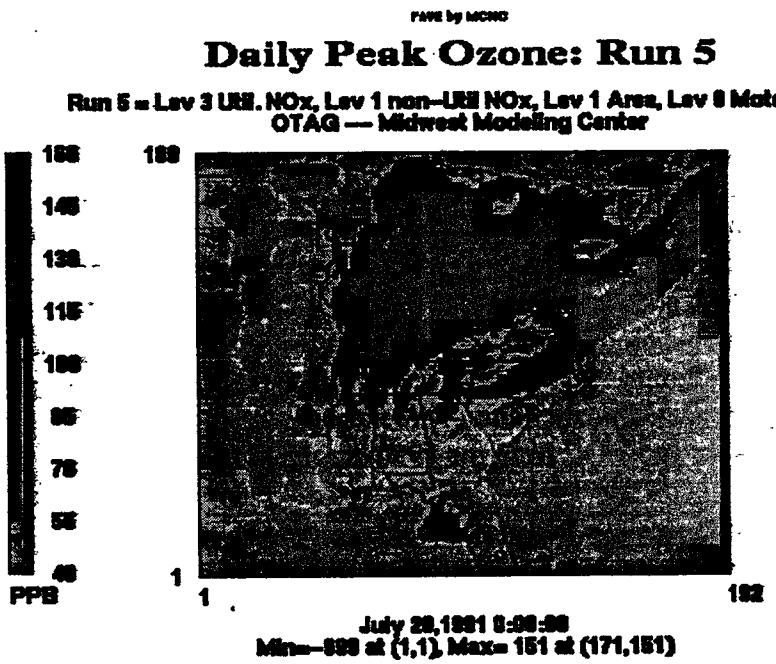
ATTACHMENT 4.

Model-Predicted Peak Ozone Concentrations from OTAG Run I and Run5 for July 20, 1991

ATTACHMENT 5.



Improving Evidence Identification of Additional Reductions Not Modeled



Weight of Emissions Modeling Through

DRAFT - Guidance for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled

by
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emissions, Monitoring, and Analysis Division
Air Quality Modeling Group
Research Triangle Park, NC 27711

October 1999

Introduction

This paper provides guidance for using information from photochemical grid modeling and ambient air quality monitoring to estimate additional levels of emission reductions needed to support the 1-hour NAAQS for ozone beyond the reductions contained in the demonstrations submitted by the States in 1998. Procedures for estimating improvements expected with the implementation of the Tier 2 low sulfur program and benefits towards attainment are also provided. Two techniques are described for estimating additional emission reductions, each with its own strengths and weaknesses. Use is made of the fact that, since 1999 is more than half-way from the model base year (1990) to the attainment year (2005 or 2007 in most areas), air quality data from 1990 to 1999 allows modelers the opportunity to determine the representativeness of the modeled predictions. These techniques identify the additional percentage reduction in NOx and VOC from the 1990 emissions.

General Procedures for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled, Including Tier 2.

To strengthen the weight of evidence and account for high modeled peaks, estimate additional measures that at a minimum bring the model estimated future design value to

124 ppb or below. This is done by first estimating a future design value using the model predicted peaks. Multiply the base design value by a ratio (average of model predicted peaks (across all days), after controls divided by before controls). The base design value is an average of three years of monitored design values that represent the modeled base case emissions. If the model estimated future design value is at or below 124 ppb, substantial levels of additional emission reductions can not be estimated and may not be needed.

If the model estimated future design value is greater than 124 ppb, estimate additional measures by using two ratios 1) modeled change in design values to modeled change in emissions and 2) air quality design value changes to NET/local emissions changes between two reference years (e.g., 1990 and 1996). Do not include biogenic emissions. First, subtract 124 ppb from estimated future design value to identify additional ozone reduction needed. Then multiply each ratio by the ozone reduction needed to estimate additional VOC and NOx emission reductions needed to strengthen the weight of evidence argument for attainment. This results in the additional percent reduction needed from the 1990 emissions.

To calculate the level of emission reductions needed (in tons per day) multiple the 1990 base emissions by the percent reductions. This results in the total tons per day reduction which are "substantial" additional reductions needed in the attainment year. To incorporate the impact of Tier 2 subtract the emission reduction estimates being applied towards attainment for Tier 2 from the "substantial" additional reductions. The remaining reductions may be adjusted to reflect other unmodeled control measures which have been quantified. The following are more details of the procedures with examples.

Estimating Additional Emission Reductions

Each of the methods described in the remainder of this paper begins with a monitored ozone concentration which can be extrapolated to the attainment year and compared with the standard. If the attainment year concentration is over 124 ppb, the methods described in this paper can be used to estimate what would constitute "substantial" additional emission reductions needed to support a weight of evidence argument for attainment. The differences among the methods lie in the factors used for this extrapolation. These are summarized in Table 1.

Both methods are based on the assumption that we can estimate the relationship between ozone and its precursors (VOC and NOx). We can estimate this relationship by either (1) comparing changes in model predicted ozone to changes in modeled emissions or (2) comparing changes in observed air quality to changes in emissions. Both methods for estimating a relationship are equally valid. Both have inherent uncertainty in estimates of emissions inventories and estimates of the change in ozone air quality. Utility of either method is dependent on the availability of data which shows a response in ozone due to a decrease in VOC and NOx emissions. For example, if an area wants to apply method 2 using the NET inventories

for the 1990 and 1996 reference years, the VOC and NOx totals for the nonattainment area must show a decrease in VOC and NOx between 1990 and 1996. If this is not the case then use of the NET data for those two reference years in not appropriate.

Table 1.

Summary of Methods for Estimating Additional Emission Reductions

Method	Ozone Concentration Being Extrapolated	Extrapolation Ratio (normalized reduction factor)
1	Future Air Quality Design Value	$\frac{\text{Change in emissions From base to attainment year}}{\text{Change in modeled concentration}}$
2	Future Air Quality Design Value	$\frac{\text{Change in emissions From base to the present year}}{\text{Change in monitored concentration}}$

Estimate a Future Air Quality Design Value

Both methods make use of the results of past modeling to derive a modeled response of ozone design values to VOC and NOx controls to estimate a future air quality design value. Relative reduction factors are derived and used similarly to what is described in U.S. EPA, (1999), *Draft Guidance on the Use of Models and Other Analyses In Attainment Demonstrations for the 8-Hour Ozone NAAQS*, EPA-454/R-99-004. If the estimated future design value is < 124 ppb, no additional emission reductions are needed to strengthen the weight of evidence argument for attainment.

(1) Calculate an average (over all modeled days) predicted daily maximum (domain wide) 1-hour ozone concentration, first with the base emissions (e.g., 1990) and then with the future emissions (e.g., 2007).

(2) Using results from step 1, calculate the relative reduction factor in the modeling domain, RRF, by taking the ratio of the average daily maximum 1-hour ozone concentration obtained with future emissions to that obtained with the base emissions.

$$RRF = AVGf / AVGc \qquad (1)$$

where

AVGf = average (across all days) predicted daily maximum 1-hour ozone concentration for future emissions, ppb.

AVGc = average (across all days) predicted daily maximum 1-hour ozone concentration for base emissions, ppb.

(3) Calculate the base design value, DVB, as the average of 3 nonattainment area ozone design values that represent the period used to predict ozone for base emissions (e.g., if 1990 emissions are used, average design values for 1990, 1991 and 1992)[15]. The nonattainment area ozone design value is the maximum monitored design value from all sites in the nonattainment area.

(4) Estimate the future design value, DVF, for the nonattainment area as the product of the relative reductions factor (step 2) and the base design value (step 3). If the future design value is < 124 ppb additional emission reductions can not be estimated and may not be needed, no additional steps are required. If the future design value is > 124 ppb proceed to the next step.

Example 1: Estimate Future Air Quality Design Value

Given: Past results from modeling indicate predicted peaks (for three days) before controls in 1990 are 195, 180, and 165 ppb and after controls in 2007 are 155, 150 and 145 ppb. There are two monitor sites in the nonattainment area. The monitored air quality design values for each site are 185 and 176 in 1990, 145 and 152 in 1991, and 155 and 140 in 1992.

Find: Estimate the future air quality design value in 2007.

Solution:

(1) Compute the base and future average 1-hour daily maximum concentration. The average of the model predicted peaks (in and downwind of the nonattainment area) for the base before controls is: (195 + 180 + 165) / 3 = 180 ppb and for the future after controls is: (155 + 150 + 145) / 3 = 150 ppb.

(2) Using the results in step 1 the relative reduction factor is: 150/180 = 0.83.

(3) Determine the nonattainment area design values representative of the episode used in the base emissions and calculate the base design value. The nonattainment area design value for 1990 is MAX(185, 176) = 185, for 1991 is MAX(145, 152) = 152, and for 1992 is MAX (155, 140) = 155 ppb. The base ozone design value is (185 + 152 + 155) / 3 = 164 ppb.

(4) The estimated future design value is (0.83) (164) = 136 ppb

This is > 124 ppb, so we need to apply the following methods to determine additional emission reductions.

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[15]Note, 1990, 1991 and 1992 design values reflect observations for 1988-90, 1989-91, and 1990-92, respectively. All of these periods include "1990", the year of the base emissions.

Method 1: Estimate Additional Emission Reductions Using Modeled Responses

Method 1 uses the change in nonattainment area monitored base ozone design value and estimated future ozone design value along with changes in modeled emissions before controls (base emissions) and after controls (future emissions) to estimate additional emission reductions.

(1) Calculate the change in air quality design value by subtracting the estimated future design value (e.g., 2007) from the base air quality design value (e.g., 1990). Estimate the percent reduction in NOx emissions and VOC emissions which occurred within the nonattainment area before and after controls. Do not include biogenic emissions. Divide the percent reduction in NOx emissions by the change in the air quality design value and divide the percent reduction in VOC emissions by the change in the air quality design value. This step results in two "normalized emissions reduction factors", one for changes in NOx emissions and one for changes in VOC emissions.

(2) Estimate the amount of additional ozone reduction needed by taking the difference between the future design value and 124 ppb, the maximum ozone design value consistent with meeting the NAAQS.

(3) Calculate additional necessary emission reductions by taking the product of each of the "normalized" emissions reduction factors (step 1) and the amount of ozone reduction needed (step 2).

Example 2: Calculate reduction factor using model predictions and apply to model estimated future design value

Given: Results from modeling used in Example 1 indicate an estimated future design value is 136 ppb and the monitored air quality ozone base design value representative of the nonattainment area is 164 ppb. The control strategy reflects a 30% reduction in VOC and a 35% reduction in NOx emissions. These reductions were obtained by comparing the modeled 1990 base emissions to the modeled 2007 attainment year emissions for the nonattainment area.

Find: The amount of additional VOC and NOx reduction needed to reduce the model estimated future design value to 124 ppb, so that a convincing weight of evidence argument can be made that unmodeled emission reductions are substantial.

Solution:

(1) Calculate the change in air quality design value as 164 - 136 = 28 ppb. The estimated percent reduction in VOC and NOx are given 30% VOC and 35% NOx. The "normalized emission reduction factors" for VOC is 30% / 28 = 1%/ ppb and for NOx is 35% / 28 = 1.2%/ ppb.

(2) The amount of additional reduction needed is (136 - 124) = 12 ppb.

(3) Therefore, the additional reduction needed in VOC is (1%) (12) = 12% of the VOC emissions. And, the additional reduction needed in NOx emissions is (1.2%) (12) = 14% of the NOx emissions.

Method 2: Estimate Additional Emission Reductions Using Observed Air Quality Changes

This method uses monitored ozone air quality design values and emissions estimates for the nonattainment area to calculate the "normalized emissions reduction factors" for VOC and NOx. These reduction factors are then applied to the model estimated future design value as calculated in Example 1 to estimate additional emission reductions.

(1) Calculate the percent reduction in NOx emissions and VOC emissions which occurred within the nonattainment area from an earlier year (e.g., 1990) to a more recent year (e.g., 1996). The National Emissions Trends (NET) inventory provides an example of these data. Do not include biogenic emissions.

(2) Calculate the change in the nonattainment area's ozone design value using the same reference years. To account for fluctuations in meteorology average three years of design values to estimate the design value for each of the reference years. The nonattainment area average design values are used to assess the observed change in air quality from the "early" time period to a "recent" time period. Monitors that were only online during one of these periods may not be representative of the actual change in air quality. Rationale for excluding a monitor should be documented.

(3) Divide the percent reduction in NOx emissions by the change in the area's ozone design value. Divide the percent reduction in VOC emissions by the change in the area's ozone design value. This step gives two "normalized emissions reduction factors", one for changes in NOx emissions and one for changes in VOC emissions.

(4) Calculate the additional amount of ozone reduction needed by subtracting 124 ppb from the model estimated future design value (see Example 1).

(5) Calculate additional necessary emission reductions by taking the product of each of the "normalized" emissions reduction factors (step 1) and the amount of ozone reduction needed (step 2).

Example 3: Calculate reduction factor using change in ozone air quality design values and nonattainment area emissions, and apply to model estimated future design value

Given: There are two monitors in the nonattainment area. The monitored air quality design values for each site for reference years 1990 and 1996 are presented in Table 2. Emission reductions between 1990 and 1996 are 30% reduction in VOC and a 35% reduction in NOx emissions. These reductions were obtained by comparing the 1990 NET inventory to the 1996 NET inventory for the nonattainment area. The model estimated future design value in 2007 is 136 ppb.

Table 2. Air Quality Design Values (ppb)

Monitor	1990 Reference Year			1996 Reference Year		
	1990	1991	1992	1996	1997	1998
1	185	145	155	140	146	139
2	176	152	140	135	145	130

Find: The amount of additional VOC and NOx reduction needed to reduce the future design value to 124 ppb, so that a convincing weight of evidence argument can be made that the unmodeled emission reductions are substantial.

Solution:

(1) The estimated percent reduction in VOC and NOx are given 30% VOC and 35% NOx.

(2) Calculate the change in the nonattainment area's ozone design value. Determine the design value for each reference year by first taking the maximum design from the two sites for each of three years and then averaging the three years design values. The nonattainment area's ozone design value for 1990 is (185 + 152 + 155) / 3 = 164 and for 1996 is (140 + 146 + 139) / 3 = 142 ppb. The change in air quality design value as 164 - 142 = 22 ppb.

(3) The "normalized emission reduction factors" for VOC is 30% / 22 = 1.36%/ ppb and for NOx is 35% / 22 = 1.59%/ ppb.

(4) The amount of additional reduction needed is (136 - 124) = 12 ppb.

(5) Therefore, the additional reduction needed in VOC is (1.36%) (12) = 16% of the VOC emissions. And, the additional reduction needed in NOx emissions is (1.59%) (12) = 19% of the NOx emissions.

Incorporate Tier 2 and other unmodeled control measures

Once the percent reductions for VOC and NOx have been determined they can be converted into tons per day reductions. Control measures used to address these additional

reductions must be quantified as estimates in tons per day reductions and compared to the level of additional reductions needed. Sufficient additional measures have been identified when the total from all unmodeled controls are equal to or greater than the estimated additional reductions.

(1) Convert the estimated percent reduction in VOC and NOx to tons per day by taking the product of the percent reduction and the total emissions in the base case inventory for each category of emissions, VOC and NOx. This results in tons per day for VOC and tons per day for NOx. These are the additional level of controls needed.

(2) Subtract the Tier 2 emission reduction estimates being applied towards attainment from the additional level of controls for each category of emissions, VOC and NOx. All other unmodeled controls should be subtracted as well. Repeat this step until no additional reductions remain.

Example 4: Adjust additional emission reductions to account for Tier 2

Given: The nonattainment area total emissions in 1990 for VOC and NOx are 1197 tpd and 927 tpd, respectively. Also, as shown in Table 3 the estimated Tier 2 reductions in VOC and NOx are 10 tpd and 25 tpd, respectively. The estimated additional emission reductions are 16% VOC and 19% NOx, as calculated in example 3.

Table 3: Nonattainment Area Emissions Summary (tpd) without Tier 2

Year	VOC				NOx			
	Point	Area	Mobile	Total	Point	Area	Mobile	Total
1990	400	447	350	1197	300	377	250	927
2007	241	282	200	723	150	312	125	587
Estimated Tier 2 Reduction =				10				25

Find: What are the additional emission reductions in tons per day still needed after incorporating Tier 2?

Solution:

(1) The additional reductions are (.16 * 1197 tpd) = 192 tpd for VOC and (.19 * 927) = 176 tpd for NOx.

(2) After subtracting Tier 2 reductions the remaining reductions are (192 - 10) = 182 tpd for VOC and (176 - 25) = 151 tpd for NOx.

Use of Results

The results from both methods should be considered along with other weight of evidence presented in the technical analyses for the attainment demonstration. For example, where model predicted peaks show greater improvement when low level NOx emissions are reduced verses VOC or elevated NOx, substituting an equal amount of low level NOx reductions for the VOC reductions is acceptable. Also, where modeling demonstrates substantial improvements in model predeicted peaks when emission reductions are applied to adjacent counties, the area of controls may be extended to include adjacent counties. However, if emissions from adjacent counties are used they must be included in the total emissions for the base case. Modeling the additional emission reductions would normally address these two example as well as the following: change in boundary conditions due to transport, location of emissions (such as point, area or mobile), elevated vs low level emission reductions, chemistry and wind flow patterns. Model sensitivity runs may be used to help identify the appropriate controls measures to fill the additional emission reductions needed to provide for attainment in the weight of evidence analyses.

For guidance on VOC and NOx substitution use the, "NOx Substitution Guidance", EPA 1993; "Transmittal of NOx Substitution Guidance", memorandum from John Seitz, 1993; "Clarification of Policy for Nitrogen Oxides (NOx) Substitution", memorandum from John Seitz, 1994; and "Guidance for Implementing the 1-Hour Ozone and Pre-Existing PM10 NAAQS", memorandum from Richard D. Wilson, 1997. The 1993 and 1994 guidance was primarily designed for the post-1996 rate of progress (3%/year VOC reduction) requirement and allowed NOx reductions to be substituted for the otherwise mandatory VOC reductions as long as the NOx reductions were shown to be consistent with the attainment demonstration (in other words, if the attainment demo relied only on VOC reductions, the area could not substitute NOx reductions for the 3%/year requirement, and if the attainment demo relied on both VOC & NOx reductions, NOx could be substituted in part). The 1994 guidance document (Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration, EPA-452/R-93-015, Jan. 1994) provided equations & procedures for calculating the amount of NOx reductions that could be substituted for VOC for the rate of progress requirements. Also, the 1997 guidance establishes the 100 & 200 km distances for substitution of emission reductions outside the nonattainment area. These documents are located on the EPA website: "www.epa.gov/ttn/oarpg/t1pgm.html".

WASHINGTON D.C. NON-ATTAINMENT AREA 1 HR ATTAINMENT ADDITIONAL EMISSION REDUCTION ANALYSIS DATA SHEET

WASHINGTON AREA 1 HR DESIGN VALUES

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
D.V.	145	165	165	165	136	136	137	137	135	135	132	131

MODEL PREDICTED PEAK OZONE CONCENTRATIONS

Episode Day	Modeled Peak Base Case	Modeled Peak 1999 Control Case
07/16/91	167 ppb	150 ppb
07/19/91	168 ppb	139 ppb
07/20/91	198 ppb	178 ppb
Average	177.7 ppb	155.7 ppb

1. Reltative Reduction Factor (RRF)= 155.7 ppb/177.7 ppb = .88
2. 1991 Base Modeling Period Design Value = 136 ppb + 136 ppb + 137 ppb / 3 = 136 ppb
3. 2005 Design Value = Base Period Design Value * RRF = 136 ppb * .88 = 119.6 ppb
4. Air Quality Shortfall = 0 ppb Therefore, no additional emission reduction are required for attainment.